EDITORIAL

AN announcement of importance to all readers of 'Metal Trades' appears on page 18 of the advertising section.

THE British committee on industrial alcohol reports that the flowers of the mahua tree, which is common in various parts of India, will yield 90 gallons of 95% alcohol per ton. No, we do not know where you can buy mahua trees.

LONGSHOREMEN at Genoa recently struck for, and obtained a wage-scale equivalent to $6.50 per day. They then hired other men to do the work at $2 per day and settled down to the enjoyment of the remaining $4.50. This shows one way by which the workingman, by patient industry, can elevate himself to the ranks of the employers.

SO-CALLED 'final' casualty reports for the American Expeditionary Force have recently been issued by the War Department. "Only slight revision" will be needed in these reports. The total killed in battle and died of wounds is given as 49,408; wounded, 205,690; prisoners (presumably all released by this time), 4480. The number 'missing' has been reduced to only two, compared with 264,000 for France and 121,000 for Great Britain.

HERE are some of the causes of the high cost of living as given in speeches recently delivered in Congress: inflation of currency, high taxes, destruction of property by the Germans, large armaments, prohibition, automobiles, governmental extravagance, movies, short working-days, wholesalers, retailers, commission men, trusts, farmers, sanitary packages, delivery-wagons, telephones, domestic servants, housewives, bad roads, delay in ratifying the peace treaty. Take your choice, or add a few more of your own choosing.

LABORERS in the Ruhr district of Germany to the number of 60,000 are reported to be working overtime in order to produce enough coal to provide a surplus to be exchanged for Danish butter. Part of the butter so obtained goes directly to these laborers. In some of the mines, the former 8-hour shift has been lengthened to 12 hours. The German is thick-headed in some things, but he seems to have grasped the truth quicker than some of the rest of us that decreased output means increased cost of living.

ONE of those curious typographical errors that will occur to plague the editor will be found on page 354 of our August issue, near the top of the second column. Substitute 'and when' for 'alum', making the sentence read "Any kind of oil that is free from acid is suitable, and when mixed with graphite will prolong the life of the rope considerably", and you will improve the sense. The suggestion also has been made that in the same article the text-reference on page 353 to a table is not connected with sufficient clearness to the table itself, which appears on page 354.

LLOYD'S REGISTER shows that on June 30 last, 2526 merchant vessels of 100 gross tons or more were being built in the various shipyards of the world. The total tonnage under construction was 8,017,767. Of this amount, yards in the United States were building 3,874,143 tons, yards in the United Kingdom, 2,524,050 tons, and yards in other parts of the British Empire, 346,453 tons. No other country was building as much as 300,000 tons. These statistics do not include Germany. Before the War, the greatest tonnage on the ways at any one time was 3,445,000 on June 30, 1913, of which 2,003,241 tons was being built in yards in the United Kingdom.

RISING wages emphasize the importance of labor-saving devices and labor-saving methods. Several articles in the present issue deal directly with various aspects of this question. In addition to labor-saving equipment, the designers of the new plant of the American Manganese Steel Co. arranged the factory layout to provide for the most economical handling of material. Another article describes some special devices developed in the machine-shop of the Moore Shipbuilding Co. for the direct reduction in labor cost. At the Joshua Hendy Iron Works the quantity production of a mine-car called for the development of special jigs, fixtures, and methods. In still another article, the application by the American Coin Register Co. of manufacturing methods to the making of machine-tools of precision is described. Finally, Mr. Richard Vosbrink, chief engineer for the Hall-Scott Motor Car Co., tells how the problem of efficient production of aeroplane-engine cylinders was solved.

FREIGHT rates on steel plates for shipbuilding from Atlantic to Pacific Coast points and on lemons from Pacific to Atlantic Coast points are exactly the same, $1.37½ per 100 pounds. The 'man from Mars' might assume from this that steel and lemons were similar in qualities and in ease of handling. This, however, we know to be untrue. Lemons are a lot of trouble to ship and are easily damaged in shipment. Steel is not. Another suggested reason is that the Railroad Administration is trying to ensure return cargoes for the cars used in shipping steel to Pacific Coast yards. This explana-

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tion is seen to be untenable when we reflect that lemons are not shipped in the same kind of cars as those used for steel, and most of the shipyards are several hundred miles away from the lemon-producing districts anyway. We give it up, but we do know that the rates on steel are unjust to Pacific Coast industry. Incidentally, the condition described does not tend to raise confidence in Government ownership when it comes to fostering industries.

Shipyard Labor Agreement

Representatives of the shipyards of the San Francisco Bay and Puget Sound districts and of the unions affected have formulated an agreement to take effect October 1, when the Macy scale expires, and to run for six months, with the possibility of renewal. The yards in the Columbia River and Los Angeles districts have refused to become parties to the agreement. At the time of going to press, the agreement has been ratified by a number of the unions, and it is expected that the remaining unions affected will follow their example. The agreement provides for a basic eight-hour day and 44-hour week throughout the year, and for a general raise in wages of eight cents per hour. This will make the wages of laborers $4.80 per day, helpers $5.28, and skilled mechanics of all kinds $7.04. The demands originally submitted by the unions provided for an increase of twenty cents per hour. They also asked for direct recognition of the closed shop, but the employers, while admitting that closed-shop conditions existed in most of the yards, were able to prevent such recognition in the agreement. Negotiations are now under way at Portland looking toward the drafting of a separate agreement covering that district.

The Emigration Bogy

Alarmists have used considerable nice white paper and good black ink recently with descriptions of a 'flood of emigration', which was attributed, according to the individual alarmist, to prohibition, capitalism, or what not. This 'flood' may exist in the mind of the nervous, but it does not appear in the official statistics. These show that during the year ended June 30 last, the number of immigrants admitted was 141,132, and of emigrants departing, 123,522. For only two nationalities, the Greeks and the Italians, was there any considerable excess of emigrants over immigrants, 14,749 for the Greeks and 34,802 for the Italians. These excesses, although they are considerable in the aggregate, are negligible when compared with the total number from these two nationalities remaining in this country. The foreign-born residents within our gates have their faults, but they also have sense enough to know that if America was a good place to come to at the time they originally emigrated, it is even a better place in which to stay at the present time.

Training Disabled Soldiers

An important feature of the rehabilitation at the various military hospitals has been the publication of various periodicals devoted to the interests of the disabled soldier, most if not all of the work being done by patients at the hospitals. Besides 'Carry-On', which was edited at the office of the surgeon-general of the Army and published by the American Red Cross, there were 42 papers issued at various hospitals. Now 'Carry On' has printed its farewell issue, and several of the hospital newspapers are following its example for the reason that there are not enough patients left to furnish the necessary staff. Here is a case where regret at the loss of these excellent periodicals is more than counterbalanced by pleasure at the reason for their discontinuance. That such a result could be obtained in less than ten months from the signing of the armistice shows that excellent progress has been made in the treatment of the wounded. However, while most of the wounded have left, or are ready to leave the hospitals, many of them are not yet trained to begin to earn their living again. The Federal Board for Vocational Education is asking for the cooperation of all employers who can assist in this training or who can employ men who have been so trained. Enough has already been done along these lines to show that there is no risk involved in employing these men, and that, in general, they are well-fitted for certain kinds of work.

The Plumb Plan

Some things would be funny if they were not so serious. In this classification must surely be placed the plan advanced by George E. Plumb, a Chicago lawyer, and endorsed by representatives of the American Federation of Labor, which amounts in effect to a proposal to surrender the operation of the railroads to a labor soviet. However, it must be admitted that the actions of Congress and the Administration ever since the passage of the Adamson bill have given the labor leaders excuse for believing in their power to get anything they wanted as far as the railroads were concerned. The Plumb plan has all the evils of the present plan of Government operation, which has nearly run the railroads on the rocks, and none of its good features, such as the retention in responsible positions of men actually experienced in managing a railroad. The proposers make many charges regarding watered stock, charges which have some foundation in fact. However, few railroad or other companies survive the buffetings of the financial world very long without having most, if not all, of the water squeezed from their securities. The history of several railroad reorganizations in this immediate vicinity during the past few years is a case in point. Water or no water, the railroads of the country are now earning little more than operating expenses and the increases in wages that the railroad employees are now asking, irrespective of the adoption of the Plumb plan,

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will more than wipe out this narrow margin. In the face of these facts, comes the ridiculous discussion of the division of the possible surplus under the soviet rule, although it should be evident to anyone that, instead of a surplus, there would be a deficit and a big one at that, unless, of course, heavy increases in freight and passenger rates should be made. And this would bring with it a further increase in the cost of living.

Individualism Versus Buck-Passing

One of the worst features of the present agitation concerning the high cost of living is that no one person or class seems willing to accept a share of the responsibility. Everybody is blaming somebody else, or at least blames 'The System'. The old-time 'Sunday-School book' had its shortcomings and its ridiculous side, but it tried to teach one very important truth, namely, that a man's misfortunes are mainly, if not entirely, his own fault, and that the thing we call luck is a mixture of hard work and common sense. These are platitudes, but they are so seldom stated nowadays as almost to have the spice of novelty. In their place we have the 'sob-sister stuff' of the yellow-journal editorial, which preaches that nobody is responsible for anything. The man that takes what he wants by force without giving an adequate return is not a very nice character, but he is a lot better than the man that sits down and howls for the Government or some other outside agency to take what he wants from somebody else and give it to him. In other words, we prefer Captain Kidd to Lenine. We could watch Captain Kidd or might even make a useful citizen out of him, but who knows what use can be made of a Bolshevist? The pioneers, who made this country what it is, were animated by no spineless collectivism, nor are any other men that really accomplish things worth while. We cannot bring back the pioneer days, even if we wished to do so, but we can foster the spirit of independence and acceptance of individual responsibility that made the men of that day great.

Andrew Carnegie

Carnegie was a Scotchman by birth, but an American by adoption, and his spectacular rise to great wealth and power as well as many traits of his character were typically American. From his first job at $1.20 per week to the purchase of his interests by the United States Steel Corporation for hundreds of millions in securities is a long distance but it was spanned in part of one lifetime. Some of the methods by which this gap was spanned would not stand the closest scrutiny according to present-day standards, but at the time they were within the law, and in accordance with the moral standards of the day. The successful men of that generation triumphed over their competitors not because they were less scrupulous but because they followed the pseudo-Scriptural injunction, 'Do unto others as they would do to you, and do it first'. However, these doubtful methods were a relatively small element in Carnegie's success. Far more important were the qualities to which he himself alluded in his proposed epitaph: 'Here lies a man who knew how to enlist in his service better men than himself'. The organizing ability was his, the special knowledge in many departments was furnished by the men he had enlisted in his service. In fact, his own knowledge of the technology of the steel business was relatively small. On at least one occasion he admitted frankly to a foreign visitor that he did not understand the exact working of the machinery in one of his plants. Yet we may feel assured that it was the best and most up-to-date machinery obtainable. And the secret of keeping these so-called better men in his service was his willingness to share with them the profits due in part to their efforts. Perhaps his principal claim to fame lies in his skill as a giver rather than as an accumulator. While he did not die poor, he succeeded in giving away the greater part of his fortune, and giving it in such a way as not to pauperize the recipient. Insofar as he could, he distributed his money to do the maximum of good and the minimum, if any, of harm. And that is an art in itself.

Profit-Sharing Plans

In another column appears an account of a profit-sharing plan recently adopted by a prominent Southern California iron works. The present industrial unrest, we are frequently told, is largely caused by the desire of the worker to have a share in the profits of industry. Be that as it may, there can be no question but that a man will do more and better work if he has some incentive other than the negative fear of getting discharged and the positive hope of promotion. Profit-sharing is designed to supply that additional incentive. As compared with other methods for obtaining the same result, it has certain advantages and certain disadvantages, which we have no space to discuss here. One form of profit-sharing is open to the employee of any concern whose securities are on the market. He can save his money and invest in stock of the company. This, however, is slow, and has many other drawbacks. This fact has led many companies to establish systems of profit-sharing differing in detail, but all making some division of the profits irrespective of whether the employee is a stockholder or not. The plan adopted in the Martin Iron Works is the result of careful study of conditions in that particular plant by the men best qualified to make such a study, namely, the staff of the company itself. While the plan has been in operation for only a short time, the results give good reason to expect continued success. One feature of the plan deserves special mention, particularly because it might easily escape attention. This is the provision that the company's 'fifty-fifty' share of the profits, after providing for interest and surplus, shall be re-invested in the

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business. Whether intentional or not, this provision is an admission that the justification for private use of property is beneficial use. A feature of the unrest already mentioned has been the demand for public ownership, demands ranging from public ownership of the railroads to complete socialization of industry. Many of our corporations, large and small, are now administered to serve the public as much as if they were publicly owned, and far more efficiently than if such were the case. If this becomes generally true of private aggregations of capital and the public becomes aware of the fact, the public-ownership agitation will subside of itself. If not it will continue to make trouble.

Low Output and High Prices

The notorious high-cost-of-living campaign that is being promoted by politicians for political purposes against so-called profiteers may accomplish something, but we doubt it. Profiteering there has been, no doubt, and, no doubt, always will be, but if our loud-mouthed political friends accomplish anything besides the expenditure of a lot of the taxpayers' money, the 'dear peepul' will be fortunate.

In the first place, we do not believe that profiteering is a large factor in the H.C.L. There has probably been more profiteering in Government contracts than anywhere else, but these will not be investigated. But if all profiteering were eliminated, and that is impossible, we doubt if the cost of living would be materially reduced as a result.

Cost of living varies with the cost of production. Four million men were taken by the Government from the ranks of the producers, but they continued to be consumers. Demand for food and clothing exceeded the supply. Farms and factories were robbed of their workers by the munition-plants, and such replacements as responded to the emergency and to high wages offered were mostly inexperienced and inefficient. Cost of production mounted higher and higher, and the cost of living naturally followed, but don't be fooled into believing that any profiteering campaign is going to bring it down again.

Economics is a big subject, and we will admit, before we start, that our knowledge of it is based mainly on bitter practical experience in trying to finance a growing family on the shrinking purchasing power of a stationary income. The following opinion of the causes of the present predicament is given as coming from a man up a tree, rather than necessarily from an authority.

The value of a commodity, with perhaps a few unimportant exceptions, is measured by the amount of labor required for its production. Unmined ore has no real value until it is turned by labor into something that can be used. Take a machinist's hammer for example. To turn it out has taken the labor of miners, blast-furnace men, steel men, drop-forgers, machinists, sailors who have hauled the ore, railroad men who have had several chances at it, salesmen, jobbers, wholesalers, retailers, printers who got out the advertising catalogues, and a host of others. And this does not include the handle which is 'something else again.' Don't think for a minute that labor means only the low-browed 'bohunk'. It includes the manager, the designer, the banker that raised the money to put the various enterprises across, just as much as it does the man with corns on his hands. Now when the labor expense is increased anywhere along the line, what happens? Why, the cost of the hammer increases also. So when there is a general increase in wages throughout the country there will be a similar increase in all the commodities that the labor produces. You can't get away from it. And that is the reason why in many cases the raise is worth nothing. A man gets a 50% raise but if he pays 50% more for everything he buys, it doesn't mean anything.

There is an answer to the problem, however, and that is production. No general increase of wages does anything but harm unless there is a corresponding increase in production. If more hammers are made for the same expenditure of labor, the laborer can get his increase and still buy a hammer at the old price. The shipyard worker gets a raise, and it costs more to bring coffee from Brazil, unless the ship can be turned out for the same price as before. The railroad men get a raise, and it costs more to bring shoes from Massachusetts, unless there is a corresponding increase in efficiency.

Under these circumstances it is the employers duty to himself and to mankind in general to introduce all the labor-saving devices he can in order to lower costs, and it is to the employee's benefit to co-operate. Anyone who preaches or practises restriction of output is an enemy of mankind and a fool besides.

With regard to restriction of output, the argument of those who believe in it is that the less work a man does the more there will be for other men, and thus more men will have jobs. Honestly, isn't it pitiful that this theory should be believed when there are so many examples to refute it? There is Henry Ford's little car. If the men laid down and only did half as much work and made the car cost approximately twice as much, do you suppose that Henry would double the crew and still produce the same number of cars as before? Well, we guess not. With the cars selling at $1200, he couldn't sell half as many and would probably have to lay off a big gang of men.

When the linotype machine was introduced, the printers threw a fit and declared that they would all be thrown out of work. Well, what happened? Cheaper printing made so much more work that today there are more jobs for printers than ever before. The world is full of similar examples. From the steam-engine down, all labor-saving machines and methods have been opposed by these same 'restriction-of-output birds', who threw wrenches in the machinery or else called a strike, in pursuit of an object that was really opposed to their own best interests. Can you beat it?

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INTERIOR OF MAIN BUILDING LOOKING EAST FROM FURNACE PLATFORM. INDUSTRIAL RAILROAD IN FOREGROUND

Manganese-Steel Making by the American Manganese Steel Company

THE Oakland plant of the American Manganese Steel Co. is situated on the Oakland west waterfront just north of the Southern Pacific mole. It is served by spur-tracks from the Southern Pacific mainline. The general layout is shown in Fig. 1. The main building is of reinforced concrete and steel, and the pattern-shop and the lavatory-building are of concrete. The office is of frame-and-stucco construction. Construction was started last winter and the plant was completed recently and is now in operation.

Manganese-steel was originally developed about 30 years ago in England, largely through the efforts of Sir Robert Hadfield. The first castings made in the United States were produced in 1892. It owes its peculiar toughness and resistance to wear to the fact that, while ordinary carbon-steels on cooling change from austenite to other forms at comparatively high temperatures, manganese-steel, on the other hand, remains austenitic. To have the desired qualities, the steel should contain between 10 and 14% manganese, preferably between 11 and 12.5%. Extreme accuracy in the control of the manganese content, is, however, unnecessary, as the steel will have practically the same properties if the manganese is kept within the limits mentioned above. The relation between the percentage of carbon and the percentage of manganese is important. A typical analysis of a manganese-steel is as follows:

	%		%
Manganese	11.62	Silicon	0.45
Carbon	1.05	Phosphorus	0.055

The amount of sulphur is negligible, as even when it is present to any extent in the charge, it unites with the manganese to form manganese sulphide and is removed with the slag. When cast, manganese-steel is hard but brittle. It requires heat-treatment to make it serviceable.

After heat treatment the physical properties of manganese-steel are approximately as follows:

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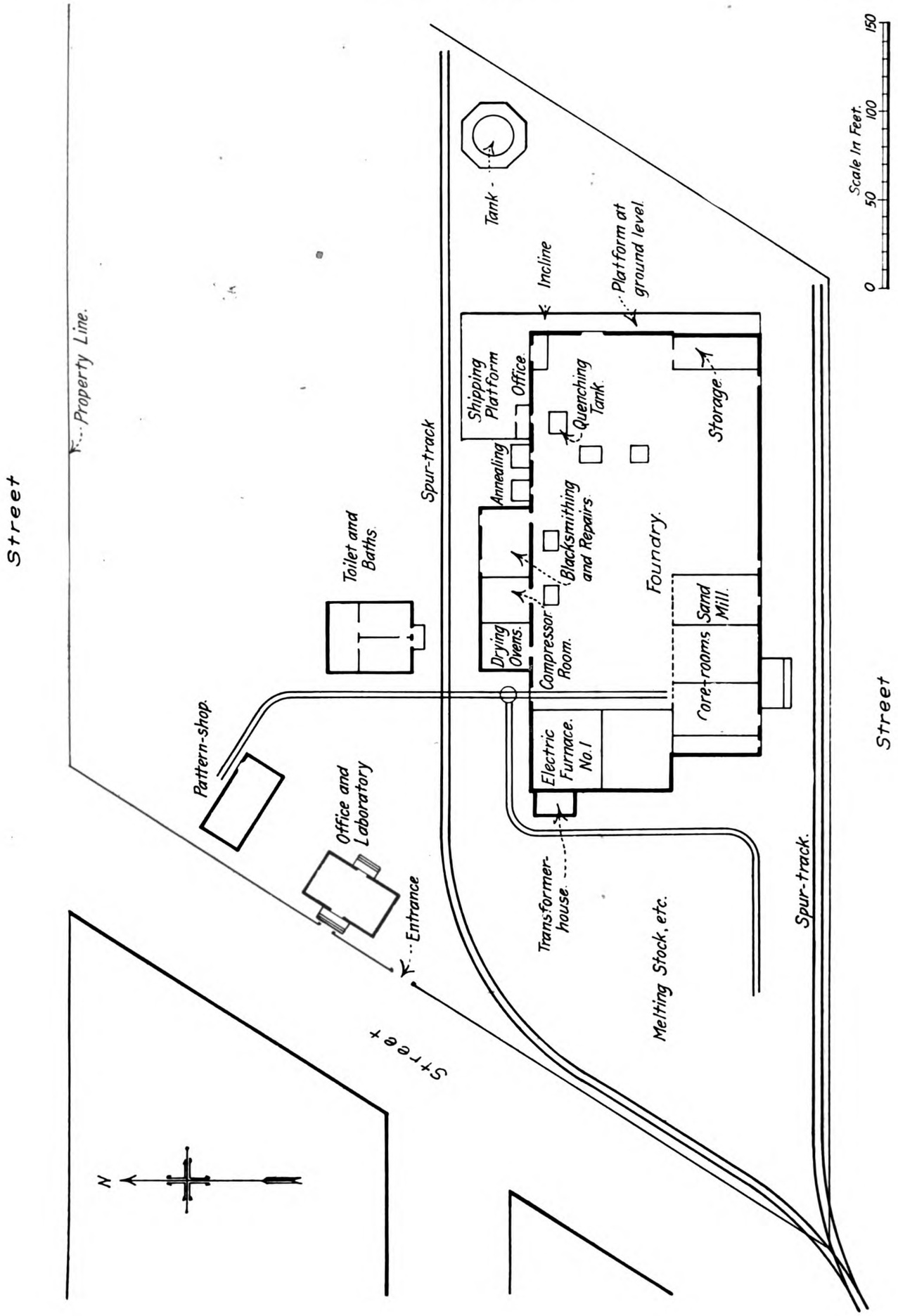

FIG. 1. PLAN OF AMERICAN MANGANESE STEEL CO. PLANT

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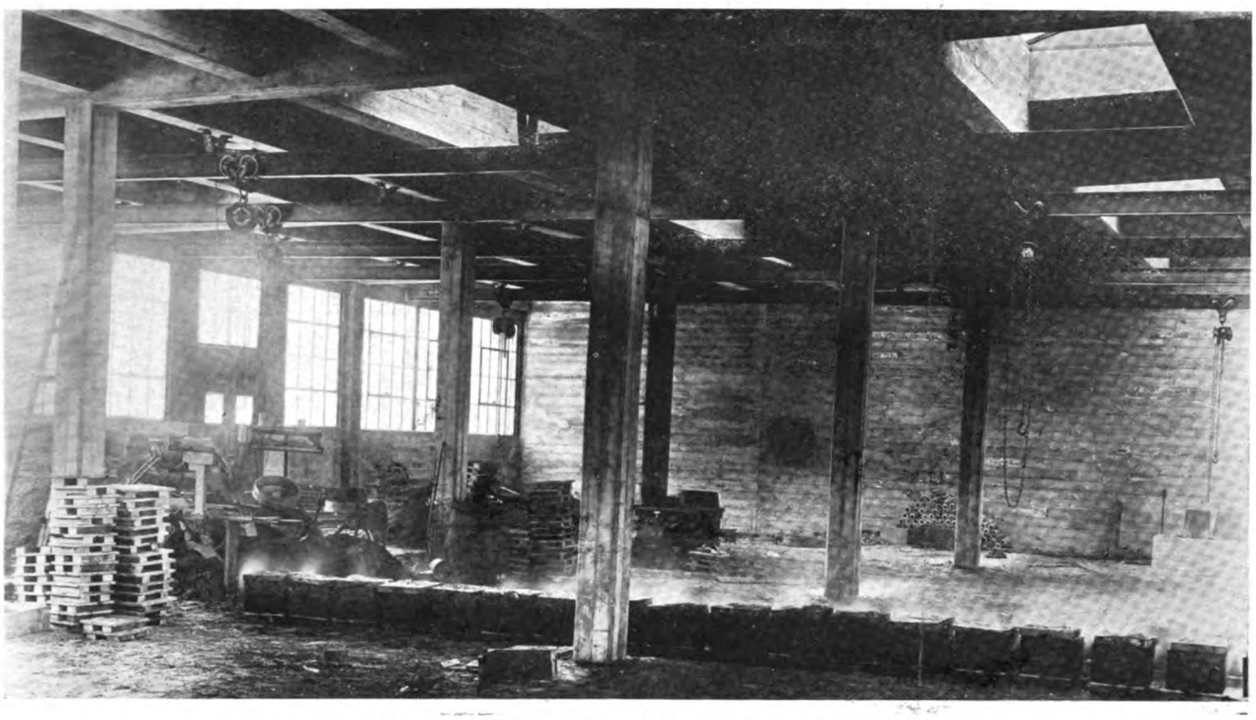
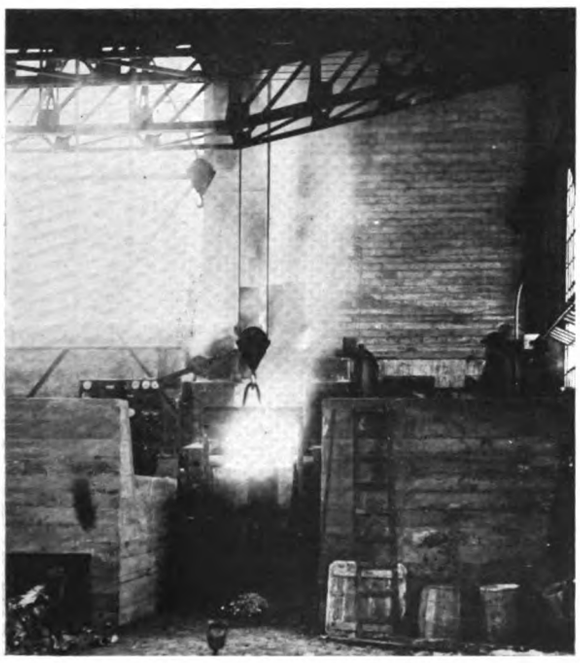


BAY FOR SMALL MOLDING. NOTE CHAIN-BLOCKS RUNNING ON I-BEAMS

Tensile strength, pounds per sq. in	90,000 to 110,000
Elastic limit, pounds	50,000
Elongation in 2 in., per cent	33
Reduction in area, per cent	35
Brinell hardness	200
Scleroscope hardness	40 to 50

The extreme outer fibre of the treated steel shows a slightly lower hardness number than at a depth of $\frac{1}{8}$ in. From the latter point to the core of the casting the hardness is uniform. The lowering of the hardness at the surface is caused by the oxidation of the carbon that forms on the surface during heat treatment. The toughness of the material is caused by its great molecular cohesion, which causes the particles to flow together rather than to tear off. It is non-magnetic.



POURING FROM FURNACE

Manganese-steel castings are used for parts for steam-shovels, dredges, crushers, tractors, stamp-mills, concrete mixers, and, in fact, for any machine or part of a machine where resistance to abrasion and to shock is of prime importance.

Because of superior control of general melting-conditions, and particularly the ability to produce either an oxidizing or a reducing atmosphere within the furnace at will, the electric furnace is especially adapted to the production of manganese-steel. The company has therefore installed a 3-ton Heroult furnace with a basic lining of magnesite brick. The usual charge is composed of steel scrap comprising punchings and turnings and ferro-manganese. It is also expected to use a considerable amount of manganese-steel scrap. Lime is used for a flux. Starting in the morning from a cold furnace, it takes from 4 to $4\frac{1}{2}$ hours to get ready to pour the first charge. The succeeding charges take from 2 to $2\frac{1}{2}$ hours.

The plant is arranged with a view to obtaining the maximum economy and convenience in handling and transporting material. Melting-stock and other material is unloaded from the railroad spur-tracks to stock-piles. From the stock-piles, a hoist loads the industrial cars, which are propelled by hand. A 5-ton and a 10-ton Cyclops traveling-crane handle the material within the foundry. From the furnace, which is of the tilting type, the metal is poured into a 'tea-pot' ladle, from which the larger molds on the main floor are poured. The bay between the sand-mill and the storage-room is devoted to

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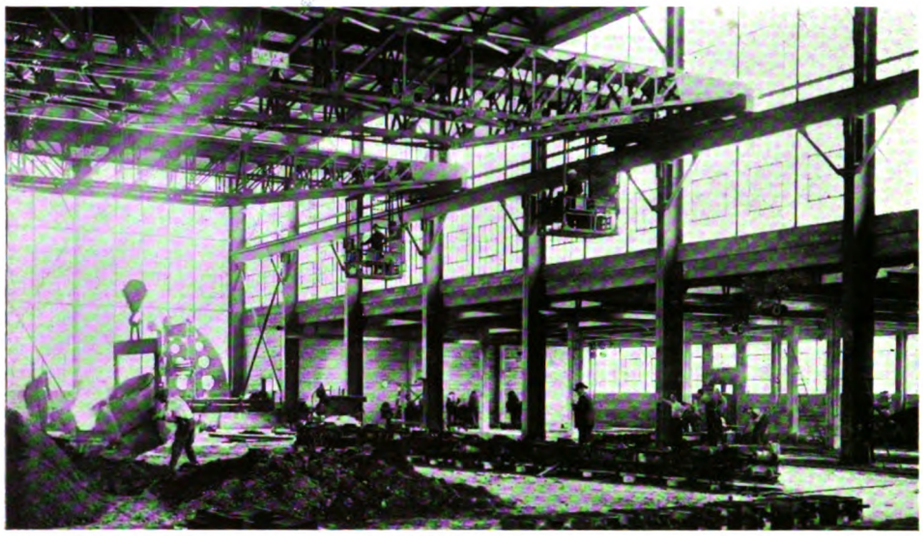
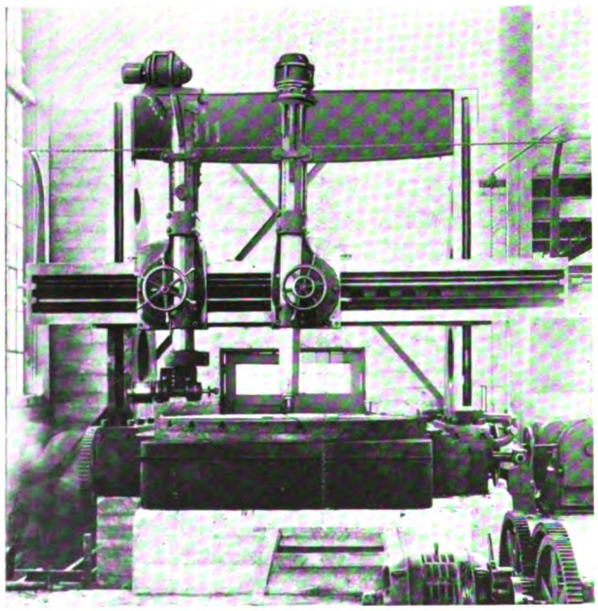
molding smaller castings. These are poured from hand-ladles. Material is handled in this bay by one-ton chain-blocks, running on I-beams.

After being removed from the molds, the castings go to the heat-treating ovens and then to the quenching-tank.



POURING MOLDS FROM LARGE LADLE

At the extreme east end of the building is mounted the grinding equipment required for finishing the castings, grinding being the only method for finishing manganese-steel. Gates, risers, etc., are cut off with the oxy-acetylene torch. A feature of the grinding department is a large



NILES BORING-MILL EQUIPPED FOR HORIZONTAL AND VERTICAL GRINDING. NOTE INDIVIDUAL MOTORS

Niles boring mill, equipped to handle both a vertical-spindle and a horizontal-spindle grinding-wheel of any ordinary size, the wheels being driven by individual motors. The smaller grinding work is done on Ransom grinders. Both carborundum and alundum wheels are used, the grain of the wheel being varied according to the kind of work. From the grinding department the castings go to the shipping platform, the entire journey from the stock-piles at the other end of the building having been in a straight line.

Both molds and cores are made of white Monterey sand, supplied by the Del Monte Properties Co. A typical analysis of this sand is as follows:

	%
SiO_2	80.00
Fe_2O_3 and Al_2O_3	12.15
CaO	2.05

The average fineness is 44%.

For comparison, an analysis of standard Ottawa sand is given:

	%
SiO_2	96.00
Fe_2O_3 and Al_2O_3	1.48
CaO	3.08

While a shipment of Ottawa sand was purchased and is now in the company's stock-pile, good results are being obtained from the exclusive use of the Monterey sand, and the officials of the company expect that they will be able to eliminate the heavy expense of importing sand from the Middle West, which has hitherto been considered unavoidable by the local steel foundries.

The principal binding-material used for cores is molasses. The sand both for molding and for cores is mixed in a Frost sand-mill. Molding machines are used wherever practical. For the smaller work, an Arcade squeezer is used, and for the larger work there are several Herman pneumatic machines, the tables for these machines ranging in size up to 4 by 5 feet.

In the compressor-room there is an Ingersoll-Rand type 10 compressor. Next to this room is a small machine and blacksmith shop, which is used mainly for repairs to the plant equipment. The oil-burning apparatus for the core-ovens, mold-drying ovens, and heat-treating furnaces was manufactured by S. T. Johnson & Company.

An important feature of the manufacture of manganese-steel castings is the need of especially accurate work in making patterns and also in placing cores. The reason for these requirements is the fact that manganese-steel is so hard that it cannot be machined economically, but must be finished by grinding. Cores should be placed to the nearest $\frac{1}{32}$ in. The shrinkage of manganese-steel is high, $\frac{5}{16}$ in. to the foot. The company makes some of its patterns at its own shop, while others are made by outside pattern-shops. To make sure that the required accuracy shall be obtained, all pattern drawings show the exact position and size of core-prints, also dimensions calculated after making allowances for shrinkage.

The Oakland plant of the American Manganese Steel

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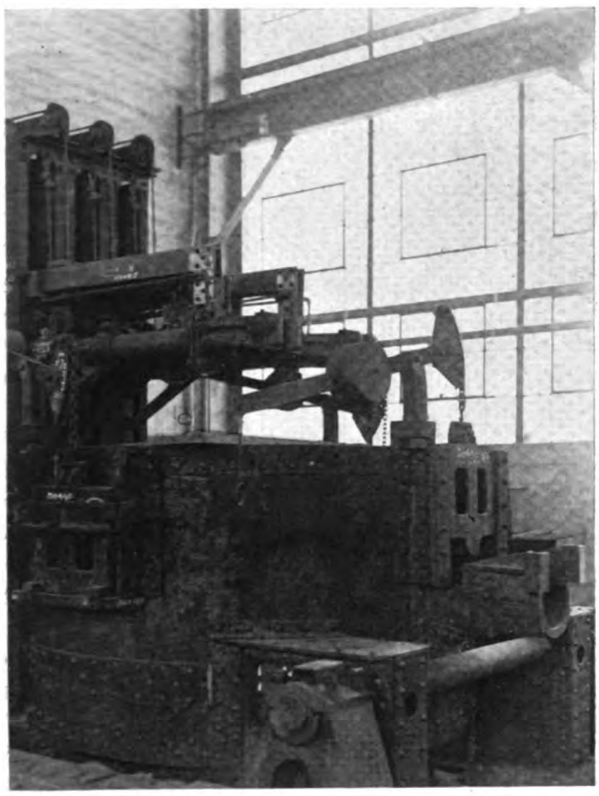
Co. is known as Plant F. Other plants of the company are situated at Chicago Heights, Illinois, and Newcastle, Delaware. The main office of the company is at Chicago, and the local office in the Insurance Exchange building, San Francisco, in charge of J. W. Plant.

The lavatory building, while not directly connected with the work of manufacture, is, nevertheless, an important feature of the plant. Individual steel lockers are provided for every man in the plant, and the locker-room is large enough so that the men can change from their working-clothes to their street-clothes in comfort. Show-



VIEW OF FURNACE DURING CONSTRUCTION

er-baths with hot and cold water are also provided, an electric heater ensuring that the hot water will be always on tap. In fact, all the facilities in this building would compare favorably with those of, say, a first-class athletic club. In this as in other details of design, the company has made special efforts to provide good working conditions, for instance, the good lighting and good ventilation of the main building.

Economical Production of Electric Steel

A recent issue of the London 'Iron and Coal Trade Review' contains an article on electric-steel making by J. A. Holden, which discusses some of the factors affecting economical production. One of the most important, in his judgment, is a low consumption of cheap and reliable current. To secure a low consumption, the right type of furnacemen are needed. Wages and bonuses paid must be sufficiently attractive to retain good workers and to induce a consistently large output. In addition to the standard wage it is advisable to pay a bonus for every ton above the output at which a profit can be made. By paying this bonus to the furnacemen and a proportionate amount to all the other men working directly on steel production, co-operation between the various departments will be promoted and efficient production obtained.

Clean scrap is much preferable to material containing waste, and other refuse. The oxidation of dirty scrap in the furnace is expensive. The carbon must be reduced to about 0.10% in order to eliminate most of the phosphorus. Consequently, high-carbon scrap is more expensive to handle than where the carbon content is lower. On the other hand, it is hard to melt a charge containing a very low proportion of carbon. The most satisfactory results are obtained from scrap containing 0.30 to 0.60% carbon.

Water-pipes and connections frequently cause trouble, because, if the water contains calcium carbonate, this will gradually be deposited in the coolers, and if they are not cleaned regularly, they will become choked. This may cause a blowout in the connections, which, if it happens during a heat, gives a choice of two unattractive alternatives. If the cooler is changed and new connections made, considerable delay in the heat is caused. If operations are continued without changing the cooler, the roof will be damaged. These difficulties can be minimized by the periodical cleaning of the coolers and overhauling the water connections. To do this effectively, two sets of coolers are required, so that one set is used while the other is being cleaned.

One of the principal items in the cost of producing electric steel is renewals of the furnace-lining. Operating continuously gives a considerably longer life than when the furnace is shut down for part of every 24 hours. No ordinary refractory material can be expected to stand heating to a white heat for one or two shifts, and then going nearly cold for the rest of the 24 hours. An instance is given where a three-ton Heroult furnace was operated continuously for six days every week, closing down on Sundays. A life of six weeks was secured from the roof and lining. To do this, several precautions had to be taken. The furnace was cleaned thoroughly after the final heat on Saturday, the hearth was packed with coke, and the doors and electrode-holes were luted with ganister. When starting for the week's work it is better to pre-heat for a few hours, commencing with a small current, and keeping the arc from striking the hearth by keeping about 9 in. of coke upon the hearth under each electrode.

The current required per ton of steel necessarily varies with the kind of steel produced. Alloy-steels require considerably more current in their production than ordinary carbon-steels.

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Martin Iron Works Adopts Profit-Sharing Plan

THE Martin Iron Works, of Los Angeles, has recently adopted a profit-sharing plan by agreement with its employees. The concern is a successor to the Kellar-Thomason Co. The principal product of the company is valves, gates, and other irrigation appliances. The plant includes a pattern-shop, foundry, machine-shop, and sheet-metal shop. About 75 men are employed. An open shop is maintained, but a number of union men are employed, and there is no discrimination against either union or non-union men as such.

The plan is described by George C. Martin, president and manager for the company, substantially as follows:

We have entered into an agreement with all of our employees along the following lines:

First—We are to pay current wages to be governed by agreement as we have handled the matter in the past.

Second—Our agreement provides that the company shall enjoy a profit after all wages and other business expenses have been paid, of 10%. Of this 10%, 6% is to be paid in dividends and 4% is to be added to surplus. After wages have been paid and in case the profits of the company exceed 10%, the excess profits are to be divided 'fifty-fifty' between the employees and the company, the company's share of said excess profits to remain in the business.

In figuring the expense of business, all items, which were considered as expense in the past will be regarded as expense according to the terms of our agreement. That is to say we will take care of profit and loss accounts, taxes, depreciation, etc., the same as we have in the past, before we can arrive at the amount of profits. The share of profits going to the employees will be divided among the employees in proportion to the salaries or wages paid during the course of the year. We have not yet determined the length of service required of the employee before he, or she, shall be entitled to a share of the profits. An employee laid off on account of sickness, accident, or lack of work, shall not be deprived of his share of profits on that account. The share of the profits shall be determined by the amount of wages actually drawn during the time of employment. An employee discharged for lack of ability, insubordination, or other cause, which seems in the opinion of the officers of the company to make him unfit for our service, shall not be entitled to a share of the profits.

The employees in the factory and office have elected a committee of seven to represent them in dealings with the firm. The actual functions and authority of this committee have not been fully determined as yet. Generally speaking, however, the company retains all of its privileges, having the right to hire, discharge, to raise or reduce pay, the functions of the committee being largely of an advisory capacity. For instance, one of the things we have worked out is this: When an application for change of pay in the factory has been made, it is referred by the foreman to the part of the committee that is elected from the department from which the application comes. The purpose of this is as follows: The committee makes an investigation by conferring with the fellow-workers of the applicant, as to his fitness for an advance, relative to the amount of work produced by the applicant, compared to the work done by other men. In making the comparison the wages of the other men are, of course, taken into account. The recommendation of the committee is not binding on the management, but is merely taken as a guide by the management in making final determination of the question. It has been found that references made to the committee and recommendations made by the committee have worked out with absolute fairness. The employees seem to appreciate the necessity of fair judgment, and their recommendations have, so far, been followed in every case.

For the purpose of eliminating slackers, we have found it necessary to make this provision: Complaint of slacking can be made by any employee, either to one of the committeemen, to the foreman, to the superintendent, or directly to the management. Such a report is confidential. We have found that the men are keen in their desire to eliminate slackers. They seem to appreciate that a slacker hurts them as much as he hurts the company, and since the scheme has been in effect, we have gotten rid of several men, who were not doing their best.

This whole scheme is predicated on the theory that, if a man has a fair chance to get a full reward for his best efforts, he will give the company the benefit of his best efforts. We have found that the men are inclined to be intolerant of one who is not doing his best.

Under this plan it is not within the power of the company to cheat the employee and no adjustments can be made that tend to give the company the full benefit of excess productions and to deprive the employees of their share. The employees' relation to the company is exactly parallel to that of a stockholder. When the books of the company are audited, at the end of the year, and the profits are determined, the question of how much was made is determined for the employees as well as for the stockholders. The State and the Federal governments have imposed regulations upon the keeping of books and accounts of corporations, which definitely fix the responsibility of the officers of the company in relation to keeping accounts. Under the regulations, for the officers of the company to juggle accounts would be an offence equally against the stockholders, the employees, and the Government. It would require some hardihood on the part of an officer of any corporation to attempt any juggling of accounts, looking to the practice of deceit upon all three of these parties in interest.

In other words this profit-sharing plan seems to me to protect the employees as fully and completely as they may be protected in the premises. I would like to say that, although this scheme has been in effect only one month, the results have been most gratifying. The men themselves have taken hold with added vigor and the result has been an increase in production.

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I wish to say, in closing, that when this matter was first introduced to the men, I made it plain to each and every one of them that the plan was not intended by the company as a philanthropic move, that no claim was made that we were doing a great kindness to anybody, and that there would be no weakness on the part of the company in enforcing all of the rights and privileges that it might have in the premises, but that the scheme was, in fact, and we hoped it would be in effect, an actual working partnership agreement, in which all parties would have an equal opportunity and a share of the profits, exactly proportioned to their contribution, either in capital or labor, to the final result, and that the plan was expected and intended to be for the gain and advancement of the company itself.

The French Eight-Hour Law

M. Colliard, Minister of Labor and Social Welfare, has issued a circular giving the official interpretation of application. A synopsis of this circular is given below:

The law itself was general, leaving administrative regulations to be worked out later, it even being left to these regulations to fix the dates when the law should become effective in a given trade, industry, or political subdivision. Employers' and labor organizations have, in the meantime, been making voluntary agreements as to the application of the law to themselves, and legislators have been more inclined to await these agreements and accept them, at least as the basis for administrative regulations, than to promulgate regulations without consulting the parties most concerned. Such voluntary agreements are, however, of no legal force if they contravene the spirit of the law, and are subject to modification by subsequent official rulings.

While the law makes no express provision for uniformity of regulations, it is the sense of those interested in its application that an effort shall be made to avoid a diversity of systems within the same industry and to bring about national agreements that shall fix the principles destined to serve as a frame for regional or local regulations.

The law is to be applied, in general, to all workmen and employees of commercial and industrial establishments and enterprises, including mining enterprises (which were not specifically mentioned in the law), and to all classes of public employees, but is not applicable to agricultural laborers.

The duration of work fixed by the law is understood to be the duration of effective work, and does not include rest periods. The law limits the daily hours of work to 8 and the weekly hours to 48, but provides for "any other equivalent limitation." It is understood that in some forms of work, such as railroad labor, the 8-hour day is not practicable, but no "limitation" can be considered within the meaning of the law if the average day's work is more than 8 hours.

The maximum of working hours may be fixed either by day or by week. If it is fixed by the week, a regulation must be made distributing the 48 hours over the various days of the week. In this way, for example, Saturday half-holidays may be provided.

It is lawful for employers and workmen to agree on a maximum number of hours which is less than that prescribed in the law. The law shall be considered as contravened only when the maximum is greater than 48 hours per week.

Public regulations may confine themselves to fixing the number of effective working hours for each day; but they may likewise apportion those working hours throughout the day, providing for and fixing the times of rest periods; and they may fix the time of beginning or of ending work.

The law provides for two kinds of derogations, permanent and temporary. Permanent derogations allow the maximum hours to be exceeded in a permanent manner and may be applied when the nature of the work is such that it must be performed outside the regular fixed hours, or when the labor performed is essentially intermittent in character. Examples of the latter sort included such workers as gate-keepers and railroad-station agents on lines little frequented.

Provision is made for temporary derogations in times of national necessity, of unexpected or imminent accidents, and for extraordinary additions of work such as sometimes occur in the rush seasons. It is left to the regulations of the public administration to determine for each industry or trade the maximum of temporary derogations permitted and the nature of such derogations.

In complying with the provisions of the law any reduction of hours from a previous normal day's labor shall not be accompanied by a reduction in day's wages.

Finally, it is declared to be the policy of the Ministry of Labor and Social Welfare to encourage the establishment of better facilities for the profitable use of the additional leisure workpeople will have as a result of the new law. Specific recommendations include the creation of courses of study for apprentices in various trades, and in some instances for adults; the opening of reading-rooms and libraries, encouragement of gardening, and increase in the number of pleasure-grounds.

Lists of Importers in Latin-American Countries

Copies of the following lists of importers of various articles can be obtained from any of the district offices of the Bureau of Foreign and Domestic Commerce by referring to the file number.

	File No.
Dealers in machinery and supplies, Guaymas and Hermosillo, Mexico	9662
Dealers in hardware, Montevideo, Uruguay	9677
Dealers in hardware and heavy machinery, Manoas, Brazil	9739
Importers of hardware, Valparaiso, Chile	9747
Dealers in hardware, Santiago, Chile	9746
Importers of hardware, Costa Rica	9655

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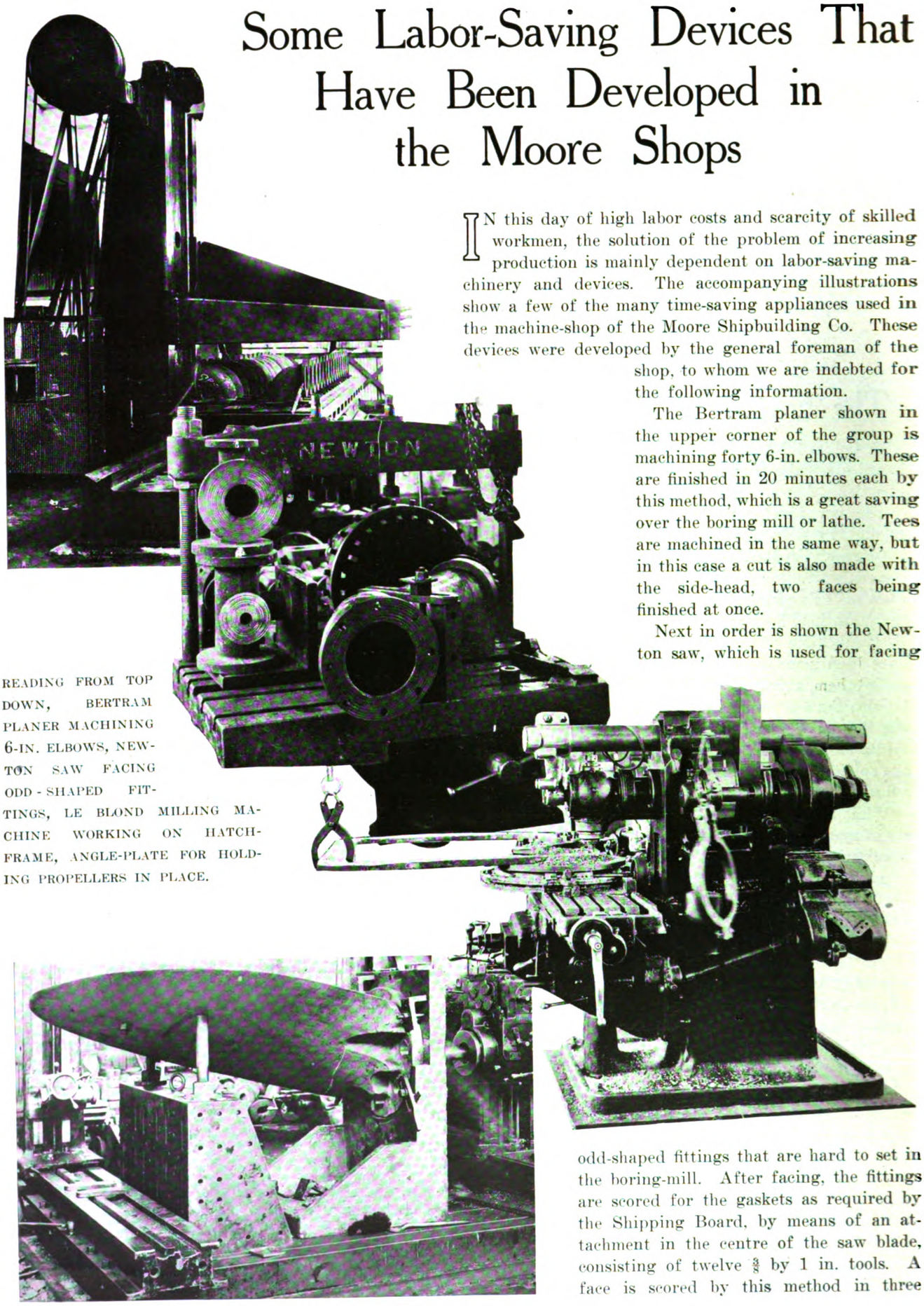
Some Labor-Saving Devices That Have Been Developed in the Moore Shops

IN this day of high labor costs and scarcity of skilled workmen, the solution of the problem of increasing production is mainly dependent on labor-saving machinery and devices. The accompanying illustrations show a few of the many time-saving appliances used in the machine-shop of the Moore Shipbuilding Co. These devices were developed by the general foreman of the shop, to whom we are indebted for the following information.

The Bertram planer shown in the upper corner of the group is machining forty 6-in. elbows. These are finished in 20 minutes each by this method, which is a great saving over the boring mill or lathe. Tees are machined in the same way, but in this case a cut is also made with the side-head, two faces being finished at once.

Next in order is shown the Newton saw, which is used for facing odd-shaped fittings that are hard to set in the boring-mill. After facing, the fittings are scored for the gaskets as required by the Shipping Board, by means of an attachment in the centre of the saw blade, consisting of twelve $\frac{3}{8}$ by 1 in. tools. A face is scored by this method in three



READING FROM TOP DOWN, BERTRAM PLANER MACHINING 6-IN. ELBOWS, NEWTON SAW FACING ODD-SHAPED FITTINGS, LE BLOND MILLING MACHINE WORKING ON HATCH-FRAME, ANGLE-PLATE FOR HOLDING PROPELLERS IN PLACE.

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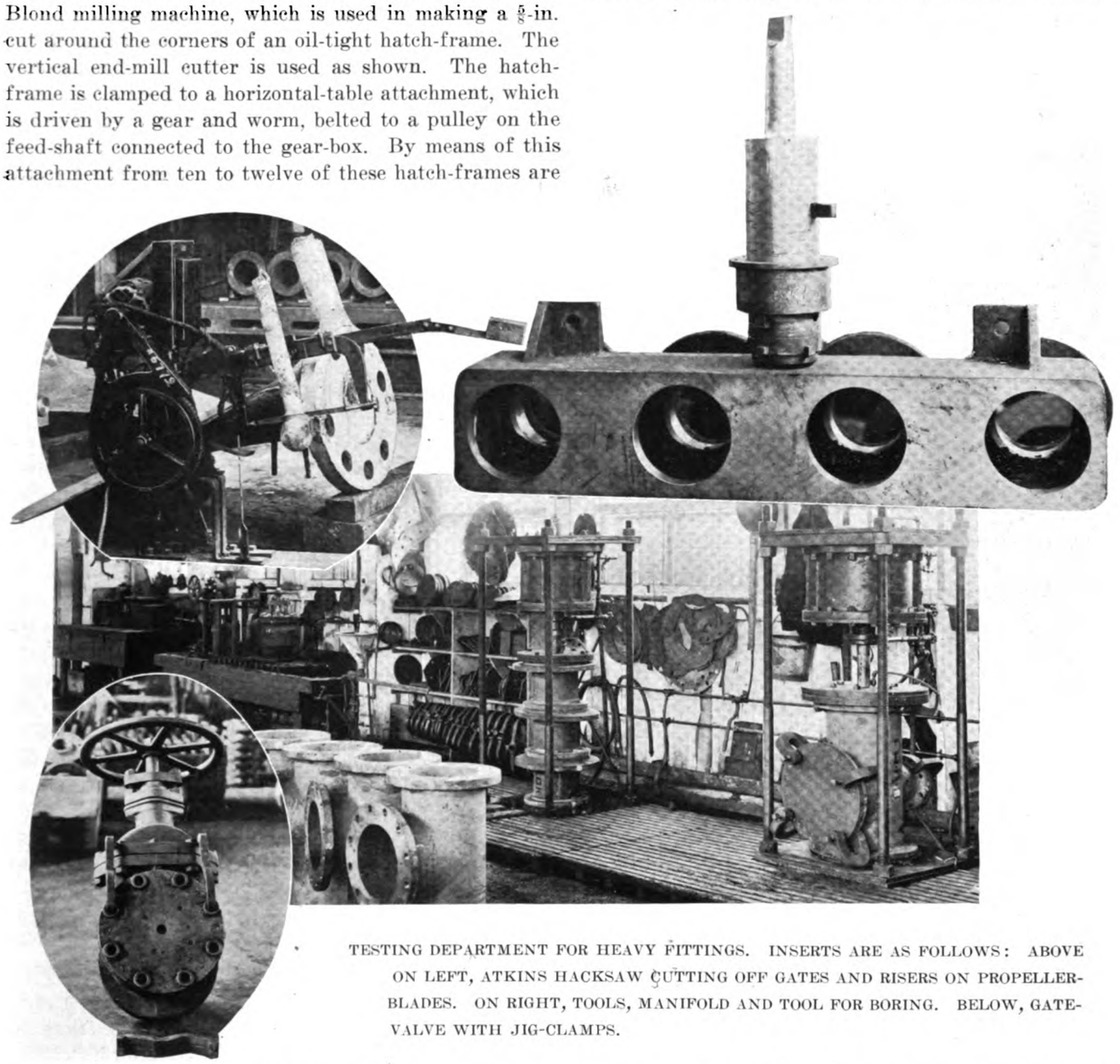
minutes. The attachment has been passed and recommended for high-pressure work by the U. S. Shipping Board.

The third illustration shows an attachment for a Le Blond milling machine, which is used in making a §-in. cut around the corners of an oil-tight hatch-frame. The vertical end-mill cutter is used as shown. The hatch-frame is clamped to a horizontal-table attachment, which is driven by a gear and worm, belted to a pulley on the feed-shaft connected to the gear-box. By means of this attachment from ten to twelve of these hatch-frames are completed in a shift. Before this device was developed the corners used to be chipped with an 'air-gun'.



TESTING DEPARTMENT FOR HEAVY FITTINGS. INSERTS ARE AS FOLLOWS: ABOVE ON LEFT, ATKINS HACKSAW CUTTING OFF GATES AND RISERS ON PROPELLER-BLADES. ON RIGHT, TOOLS, MANIFOLD AND TOOL FOR BORING. BELOW, GATE-VALVE WITH JIG-CLAMPS.

The angle-plate shown at the bottom of the group is used for holding the propeller-blade while boring the holes for the studs and counter-sinking for the nuts. The angle-plate not only obviates the necessity for blocking up the propeller-blades but also acts as a jig. The foot of the propeller fits into a recess in the back of the angle-plate, then with the pitch-line set to a mark on the plate, the drilling and counter-sinking can be done from the layout on the front of the angle-plate. The operation is done on a Landis mill.

The testing department for heavy fittings is shown in the smaller group. The machines were invented and patented (serial No. 257,605) by W. H. McKenzie. The device for holding the fittings is operated by a water-cylinder using city water at 65 lb. pressure. The machine will take fittings 4 ft. long by 16 in. diam., and will test up to 250 lb. pressure in four minutes. Small fittings are piled one on top of the other and tested together as shown. Mr. McKenzie is now making a tester with water-cylinders on the sides also, so that four-way fittings will not have to be blanked before testing. The tester has been in use for 14 months and is operated entirely by unskilled labor. The fittings for 20 ships have been tested by means of this apparatus, which has been approved and recommended by the United States Shipping Board.

The tool on the manifold is for boring, facing, and counter-boring manifolds or valves in one operation on a drill-press. With this tool these operations are accomplished in less than one-third of the time formerly required on a boring-mill.

The Atkins hacksaw shown in the group has been

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rigged to cut the gates and risers off the bronze propeller-blades. The cuts are made by this machine in 25 minutes as against 3½ hours formerly required for removal by chipping.

The gate-valve shown at the bottom of the group shows the application of the jig-clamps for placing the jig-plate so that the holes will be laid out in the correct position and the valves stand straight in the line. With the use of these clamps a machinist does not have to lay out the centre line. There is a jig equipment for every size of valve. The drilling is done on a Fox eight-spindle drill.

MAIN BAY OF MACHINE-SHOP, MOORE SHIPBUILDING COMPANY

Carbon-Steel Cutting Tools with High-Speed Steel Tips

An article in 'The Journal of Industrial and Engineering Chemistry' describes a method used by the J. B. R. Tool Works, Manchester, England, where the machine-tools are made with a carbon-steel shank to which is dovetailed and welded a piece of special high-speed steel, which is subsequently hardened and ground in the manner of an ordinary high-speed steel tool forged from the bar. The tips last until they are ground-off by use, and when this happens, the tools can be re-tipped by the same process. The cost of these tools, which can be supplied in a number of standard shapes is said to be about one-fifth of that of the ordinary cutters.

PASTOR—"Don't you think I touched them rather deeply this morning?"

Deacon—"I haven't counted up yet."

Fusible Plugs for Boilers

A paper to be presented at the September meeting of the American Institute of Mining and Metallurgical Engineers by L. J. Gurevich and J. S. Hromatko of the U. S. Bureau of Standards gives the following conclusions regarding the manufacture of fusible tin plugs for boilers:

1. The pig-tin should be at least 99.7% pure, containing not more than 0.1% of either lead or zinc. These are the requirements of the Steamboat Inspection Service.

2. The casing should be of bronze. Small amounts of lead and zinc increase the ease of casting and machining and are not objectionable if not present in greater amounts than in the following mixture:

	Mix. A, %	Mix. B, %
Copper	88	87
Tin	10	7
Zinc	2	5
Lead	..	1

3. The pot or crucible for melting the tin should not be used for melting other metals, thus eliminating the danger of contamination of the good tin.

4. Casings should be tinned on the inside with the same grade of tin as is used for filling, but the tin left over from this process should not be added to the filling to be used. Hydrochloric acid flux is the best but zinc-chloride is permissible. However, it is unnecessary to use any flux.

5. The casing should be pre-heated to not above 482° to 527°F., and the tin should be poured at not above 527° to 572° Fahrenheit.

AN ORATOR at a street corner told his audience of the blessedness of humanity. While he was speaking, two little dogs strayed into the middle of the crowd. "Now," said the orator "here we have an object lesson thrust right into our hands." He turned to a sturdy youth. "My little man, if these two animals were to fight, what would you do?" An impressive silence settled upon the crowd while the unwashed youth studied the problem. "Well, guv'nor," he said at length, "I think I'd bet on the black 'un."

A DISCOURAGED LAWYER remarked to the court, "My poor client is little likely to get justice done her until the judgment day."

"Well, sir," said the judge, "if I have an opportunity I'll plead for the poor woman myself on that day."

"Your Honor," replied the other, "will have troubles of your own upon that day."—Los Angeles 'Times'.

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Vocational Training*

By A. P. FLETCHER†

LESS than a week ago, I was sitting in a meeting with a group of Cleveland employers, and one man said: "Yes, we would like to put in a training school in our factory, but this is what would happen: we would just be training men for the other employers of Cleveland, because the minute we would get them trained, they would go somewhere else." Many employers take that attitude. The employers have not been altogether guiltless in this matter of training their employees. I had been reading about one city having a great deal of labor trouble. I investigated during one year, the industries of that city, being in educational work there, and I found that they had a peculiar apprenticeship system in a number of their factories. They would say to a boy, "If you want to come in and learn the machinist trade, we will be glad to take you in." They had a limited apprenticeship for which the boy got ten cents an hour the first year, and twelve to fifteen cents later. But the interesting thing about that apprenticeship system was that in all of these factories, after a boy had served for three years as an apprentice, he had to quit the job with the factory that had trained him and go to work somewhere else. I never could get any reason from these employers as to why they fired a boy after they had trained him. It struck me there must be something wrong with their training. I am afraid there was something of exploitation in that method of training, and that the boy, instead of being given a real apprenticeship, was being used at small wages to do operations on one or two machines, and when the firm had gotten this, the boys were fired.

But employers have not been the only ones who have failed in training boys and young men for industry. The attitude of organized labor has often worked against the training of boys. I remember that I got a great surprise, one time, in speaking before a labor lyceum. When I finished speaking I gave them an invitation to ask questions, and put me on the rack for a few minutes. Two or three of the men got up and said: "No, we don't train boys, we teach them just as little as we can." Another thing I remember one of them said: "I am a plumber. Whenever I have a particular piece of work to do, I send my boy back to the shop for something, so he shan't see how I do it." I think probably that wouldn't represent the average workmen, but it represented one class of workmen who teach the boys as little as they can.

Other workmen said to me: "We would be delighted to help the boys, but we are speeded up so, such a demand is made on us for production, that we don't get time to show the boys."

Still another class of men have boys under them, and although they themselves don't say so, the employers say they don't know enough to teach the boys anything; they know just enough to get by with the jobs, and they don't try to train the boys under them. They couldn't give anything like an adequate training.

I have laid part of the blame for our lack of skilled mechanics at the door of the employer, a bit of it at the door of the employee, but the school has been to blame also. The school of yesterday and today has not done the thing that it ought to do for the boys and girls. You know, our education was imported; most of our citizens were imported also, one time or another, and our education was imported from Europe at a time when education was thought to be only for the leisure class, and the kind of education that was imported was classical education. That was the time when the men, as is too much the case in Europe, were divided into two classes, those who do work and those who do not work. I remember reading of one man who said: "We want to bring education to the United States and institute it here in such a way that every boy, rich or poor, can go to college." That was the idea of a classical education. And, as you know, that led directly to the professions of law, medicine, and theology.

You know the problems in the text-book and the problems of real life are altogether different. Our schools have been slow to learn that you must give a boy a real job if you are going to have him know how to do things in real life. Why, we have not even taught boys in our public schools how to apply for a job. I had an interesting experience along that line. I advertised for an elevator-boy, and 30 boys came in to apply. They sat down in a large room. I sat at a table, and the boys sat around the room. I called them up one at a time and asked them what their qualifications were for running an elevator. Although in an office, and I had my hat off and other people had their hats off, not a boy took off his hat. So I decided I would give the job to the first boy that took off his hat. Not one of those thirty boys took his hat off, and not a boy got the job that day.

I am hopeful that we can find some way of co-operating with you so that we can turn the boys directly into your plants. Here is the thing right now that I wish we might do. In all of our schools we have boys who need to work; their parents in many cases are obliged to send them to work, and every day boys come to the principals of the schools, who say: "I must leave school and go to work." If we could say to that boy: "We will get you a half-time job with some of the employers in Cleveland, that will pay your way through school the other half of the time," it would be the greatest thing for them that could possibly be done.

*Abstract of address delivered before the Cleveland Engineering Society.

†Superintendent of vocational education in the public schools of Cleveland, Ohio.

Host—"Won't you try a piece of my wife's angel-cake?"

Guest—"Will it make an angel of me?"

Host—"That will depend on the kind of life you have led!"

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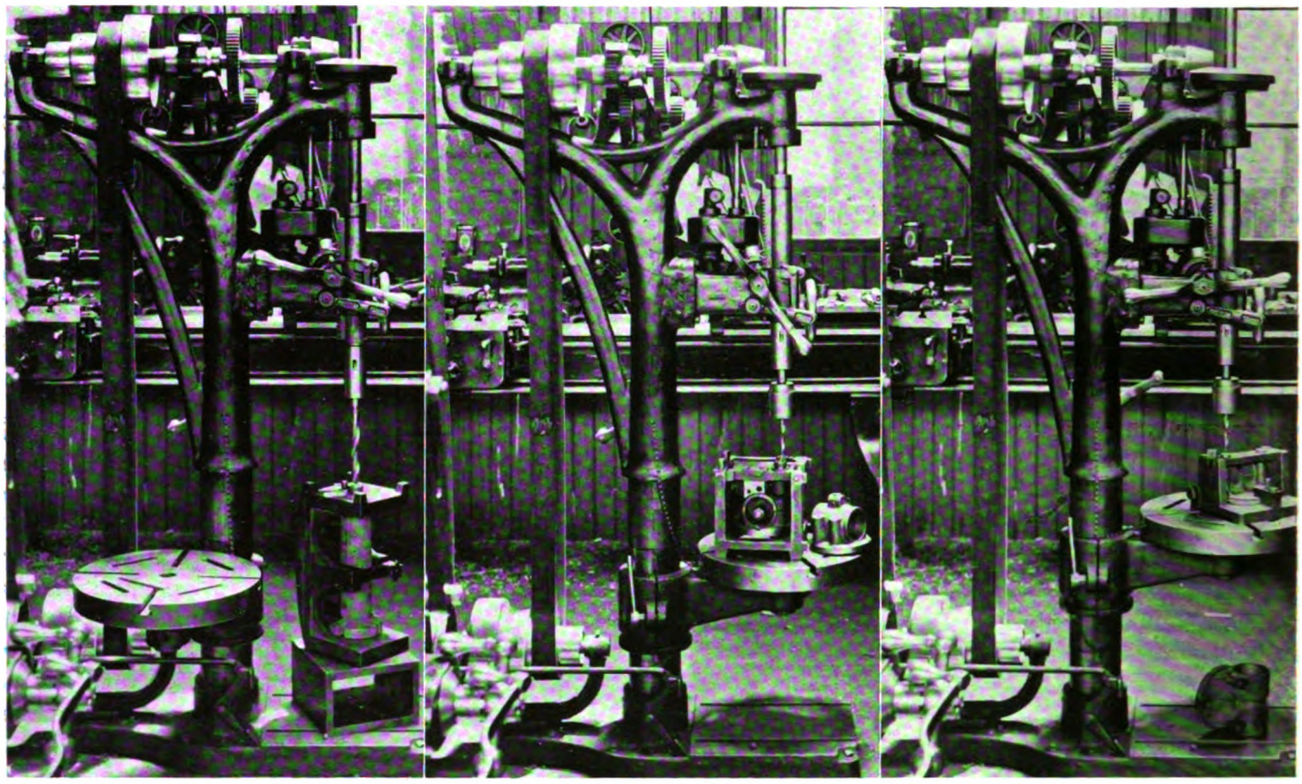

FIG. 5, 6, AND 7. FIXTURES FOR DRILLING AND REAMING COLUMNS, FOR COLUMN-CLAMP-SLEEVE, AND FOR DRILLING HOLES FOR CLAMPING-BOLTS

Quantity Production by the American Coin Register Company

THE American Coin Register Co. of Emeryville is to manufacture a large number of Moor lathe-attachments for Eccles & Smith of San Francisco. Preparatory to making these attachments on a quantity-production basis, fixtures and jigs have been built to simplify the machining operations and to lower the cost of production. Through the courtesy of the American Coin Register Co., 'Metal Trades' was permitted to photograph a few of the lathe and drill fixtures, which were set up for this purpose in the tool-room.

The lathe-attachment being manufactured is the invention of Edward N. Moor, of San Francisco, and has been developed after 12 years of labor and experiment. It converts an engine-lathe simply and quickly into a universal milling and grinding machine. A number of the early models are in use in small shops and are regularly performing such operations as cutting gears, milling keyways, squaring axles, and grinding wrist-pins. The attachment meets with favor among its users and fills a long-felt want in the small shop, which is usually equipped with a lathe and drill-press only.

The drilling fixture shown in Fig. 5 is for centring drilling and reaming columns. It holds the rough casting and centres it true on both ends, preparatory to the casting being fastened on an arbor for turning and grinding. By this means the amount of iron to be removed is kept at a minimum. The hole bored by means of this fixture also serves as an accurate column hold-down bolt-hole.

The middle drilling fixture is for the column-clamp sleeve. This operation follows the one shown at the left. Six different holes are bored from three sides. The fixture is self-centring from the bore of the sleeve.

The fixture shown at the right is for drilling the three holes for the clamping bolts in the spindle clamp-sleeve. The work is located from the surface and recess previously faced and is centred in relation to the bushings by stops at the rear of the jig. This operation follows that shown in Fig. 3.

The face-plate fixtures shown on the lathes all have the back fixed so that they can be set up on the face-plate without the use of an indicator. Beginning at the top, Fig. 1 shows a fixture for boring the column-clamp sleeve. This holds the rough casting and centres it by its outside

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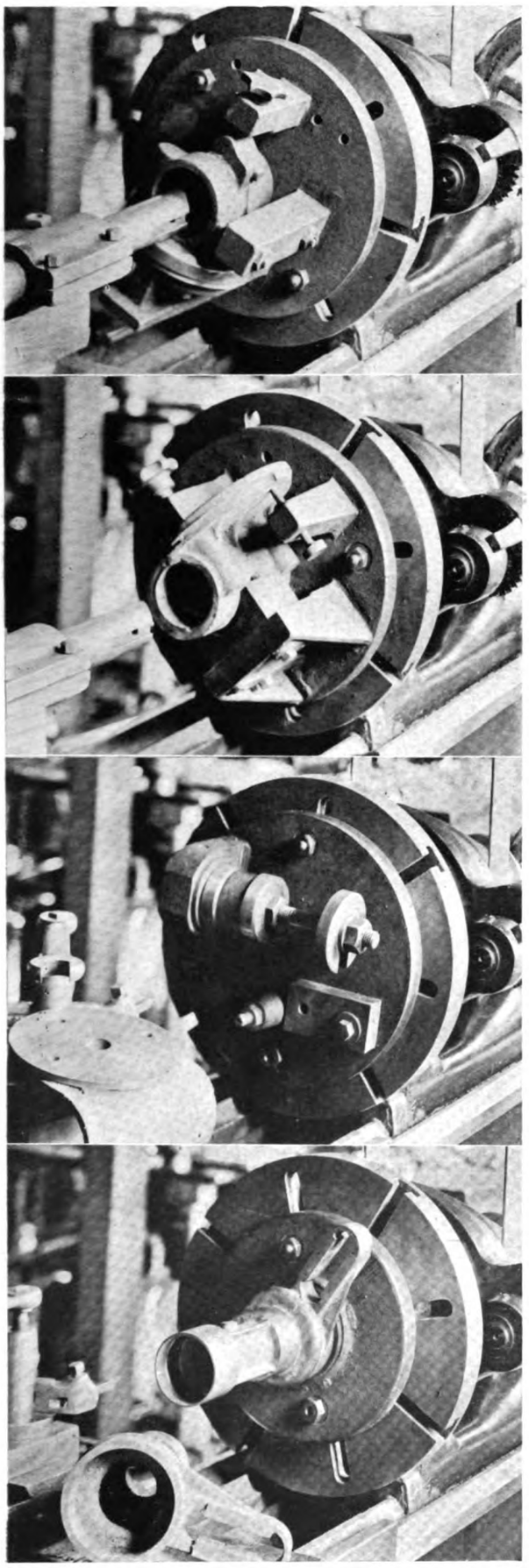
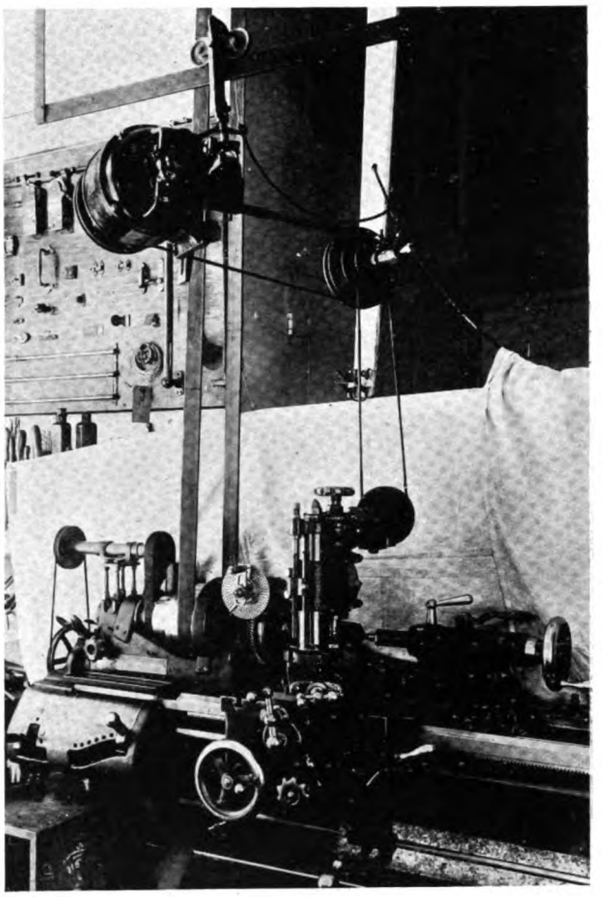


FIG. 1, 2, 3, AND 4



THE MOOR LATHE ATTACHMENT

diameter. The casting fits on an angle-plate and is held in place by screws, which are adjustable. One of these screws acts as a lock. This boring operation centres the job for three other operations on the same piece.

Fig. 2 shows the boring fixture for the spindle-clamp sleeve. The casting rests on a V-block, which centres it. Two adjusting screws hold it in place.

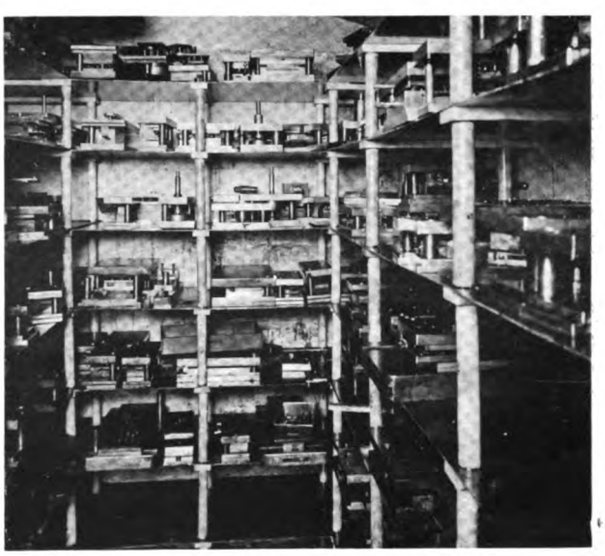


FIG. 10. PART OF DIE-VAULT

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Fig. 3 shows the fixture for turning and facing the graduating diameter and boring-pilot counter-bore on the spindle-clamp sleeve, the same casting as shown in Fig. 7. In order to show the fixture the casting was not placed in position, but is shown lying on the bed of the lathe in front of the fixture. The sleeve is slid on the column at the top of the fixture, and the part to be faced is dropped back against a height-gauge. It is then tightened into position by a left-hand thread on the end of the stud. This operation provides a means of facing the bottom of the sleeve accurately with the bore.

Fig. 4 shows the fixture for turning and threading the milling-spindle housing. The large end of the housing has already been turned and threaded while being held in an ordinary four-jawed chuck. For turning and threading the smaller end the housing is then screwed on the face-plate fixture, which holds it in exact alignment. The threads on each end are for holding Timken roller-bearings. The outside diameter is turned to fit into the spindle-clamp sleeve.

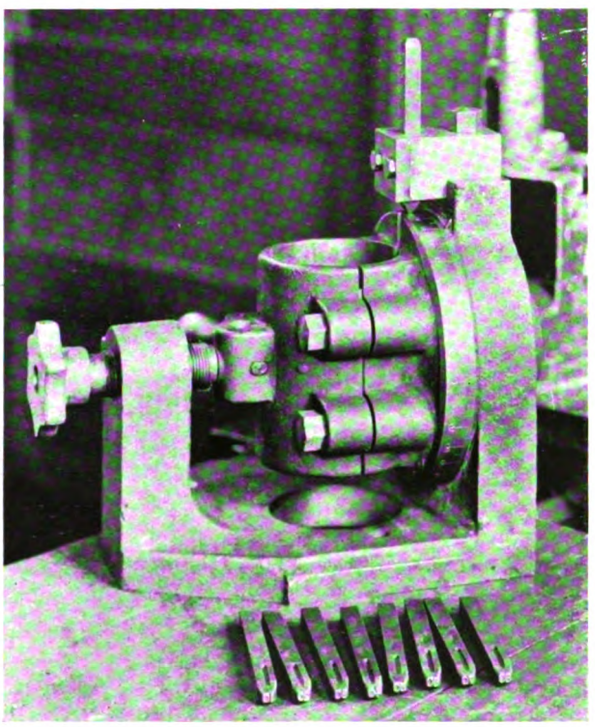

FIG. 8. NUMBERING FIXTURE

Fig. 8 shows a marking fixture for stamping squarely and accurately the degree-numbers on the graduated circle. There is a pointer on the fixture for getting the exact position of the figures in relation to the proper graduation. The dies are slotted and will fit into the guide only in one position.

By removing the top-feed, which holds the die, the fixture is used for milling the key-way in the same piece in a drill-press with a National Machine Tool Co. key-way miller.

Fig. 9 shows an automatic machine devised by Mr. Moor for graduating the circumference of the column-clamp sleeve in degrees. This machine, by the way, was made entirely by Mr. Moor on his lathe using one of the completed lathe attachments. The bar *A* carries the cam *C* which receives an up-and-down movement from an eccentric on the wheel *B* operated by the crank. The cam is revolved by the ratchet-arm *D*, also driven from the wheel. The cam, in its up-and-down movement, drives a shaper-cutter which marks off the graduations in three lengths. At the 'five' mark, the cutter is given a slightly longer stroke by a pin on *C* coming in contact with the head of the cutterslide. For the 'ten' mark, which is still longer, a second pin of the desired length is used on the surface of *C*, 180° from the first pin. The work is revolved by the worm and worm-gear, which are driven by another ratchet-arm *E*, also operated from the wheel *B*.

Fig. 10 shows a part of the fireproof die-vault. This vault contains metal-stamping and drawing dies valued at $80,000. These dies were designed and made in Emeryville for stamping out the parts of the 'pay-as-you-enter' car-box system manufactured by the company.

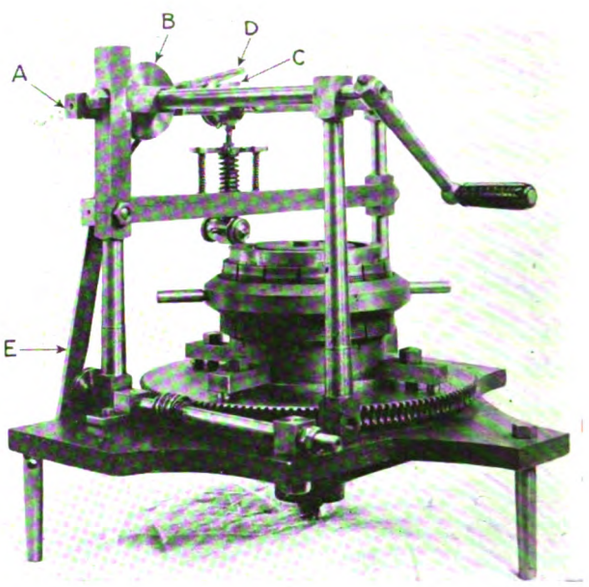

FIG. 9. GRADUATING MACHINE

Vocational Classes to be Opened for Employees at the Bethlehem Alameda Plant

Vocational classes under the Smith-Hughes Act will be opened about September 15 for employees at the Alameda plant of the Bethlehem Shipbuilding Corporation under the auspices of the Board of Education of the city of Alameda. The Corporation provides free quarters and equipment, and the remainder of the cost is provided from Federal, State, and city funds. The classes will meet twice a week, from 5 to 7 p.m. Instruction will be given in draughting, shipfitting, descriptive geometry, machine-shop practice, electric welding, riveting, and general electrical work.

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Pulverized Coal for Metallurgical Furnaces

In a paper on 'Pulverized Coal' recently published in the 'Journal' of the American Society of Mechanical Engineers, N. C. Harrison, superintendent for the Atlantic Steel Co., of Atlanta, Georgia, discusses incidentally, its use in open-hearth and other metallurgical furnaces. One of the first applications of pulverized coal in this work was made by the American Iron & Steel Manufacturing Co., now the Bethlehem Steel Co., at Lebanon, Pennsylvania, at whose plant this form of fuel was applied successfully to heating, busheling, and puddling furnaces, this being the first attempt to apply it in the steel industry. Each type of furnace presents different requirements as to the kind of burners to be used.

All open-hearth furnaces now in operation using pulverized coal are of the reversing type. At one time the American Iron & Steel Manufacturing Co. fired its open-hearth furnaces from one end only. Waste-heat boilers and economizers were constructed at the other end. This arrangement was a success as a waste-heat boiler, but a failure as a steel-making plant. The furnace was afterward remodeled. In the usual design, the pulverized coal is delivered into storage-bins at each end of the furnace. On the bottom of these are screw-feeders, driven by variable-speed motors. These carry the coal by gravity to the burner-pipe. At the burners compressed air and fan-air are both used.

The hearth of a furnace using pulverized coal is practically the same as any other open-hearth furnace, but other parts of the furnace are different. The uptakes are made as small as possible to hold the gases in the furnace as long as possible without blowing. The slag-pockets are made large so that the gases will have a low velocity and will deposit a large proportion of the suspended particles. Only one checker-chamber is needed at each end of the furnace.

The best coal for pulverizing for open-hearth work is a bituminous product having not less than 32% volatile matter and not more than 8% of ash. It should be ground so that 97% should pass the 100-mesh screen, 85% the 200-mesh, and 70 to 75% the 300-mesh. In order to obtain complete combustion before the flame strikes the bath the distance between the burners and the bath should be 6 or 8 ft. Sulphur does not give any trouble as long as there is a good draft and the furnace is working hot. At the plant of the Atlantic Steel Co. coal containing 1% of sulphur is used and good results are obtained.

Comparative figures are given showing that it requires 6000 cu. ft. of natural gas, 40 gal. of fuel-oil, or 500 lb. of pulverized coal to make a ton of steel.

He—"You know I love you—will you marry me?"

She—"But, my dear boy, I refused you only a week ago."

He—"Oh! was that you?"

Heat-Treatment of Connecting-Rod Bolts on Diesel Engines

Through the courtesy of R. W. A. Brewer, a member of the Diesel Engine Users Association of England, we are able to present a summary of the discussion at a recent meeting of this Association regarding the failure of the connecting-rod bolts on a Diesel engine in a large English factory. The engine was a Williams & Robinson 200-hp. four-cylinder Diesel engine. The crank-pin bearing end of the connecting-rod had broken adrift, and considerable damage was done to various parts of the engine as a result of the accident. Of the two bolts holding this end of the connecting-rod, the one on the platform-side had failed first, showing a clean tensile fracture and 'shortness' of material. This caused the failure of the other bolt and consequently the remaining damage. The crank-end bearing of the rod had been changed recently and the engine had worked 456 hours from then until the time of the accident. This, however, does not show the length of service of the bolts, as the bearings are interchangeable and spare parts are kept, so that the bolts are rested in turn, making it impossible to determine the exact length of service of each bolt.

In the discussion, it was brought out that the 'resting' already mentioned could not be expected to improve the life of the bolt, and it was recommended that, besides inspection, a definite time of service be fixed, at the expiration of which the bolt should be heat treated again, no matter how good its appearance. Wide differences of opinion existed regarding this length of service, the suggestions ranging from 5000 to 20,000 hours. Mild steel, heat treated after machining, was recommended for such bolts. If the carbon content was not known already, it should be determined before heat treating. The heat treating should be done in a closed box with the bolt surrounded by 'spent material' in order to prevent scaling. The electric furnace presented many advantages over other types for heat treating. The danger of stresses being caused in the bolt by the bearing-surface not being at right angles with the axis of the hole was mentioned. The use of spring-washers under the bolts in order to prevent these stresses was suggested.

Bureau of Standards Studies Effect of Phosphorus on Steel

The effect of varying the proportion of phosphorus in steel is now being investigated by the U. S. Bureau of Standards. The investigation will include the determination of the limiting quantities permissible in various grades. This question becomes of special importance now that low-phosphorus ores are being exhausted in certain regions. Studies will be made of the effect of phosphorus on the microstructure of open-hearth carbon-steel, both basic and acid, after the steel has been subjected to various heat-treatments.

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Trading With Mexico

At the present time, there is a demand in Mexico for almost every kind of machinery and metal equipment. This is particularly true of agricultural machinery and implements, on which there is no duty. The Mexican Department of Agriculture has entered into contracts with American manufacturers for 200 tractors, 1000 gang-plows, and 1000 threshing machines. A large number of trucks suitable for agricultural purposes will also be secured. Demonstrations of the practical use of this machinery will be made in various parts of Mexico, and the implements will then be sold to farmers at cost on time payments.

Henry Ford has submitted a plan to President Carranza for the establishment in Mexico of a plant for manufacturing tractors. The plan is to educate Mexican mechanics in the Ford plants in the United States and then send them to Mexico to operate the factory there.

The business being done by local banks in Mexico City at present consists almost entirely of foreign-exchange transactions. Some of the banks are handling commercial credits to a limited extent, and they make advances on bills of lading with insurance policy attached, covering local shipments, at interest charges of 2 to 5% per month. One bank is financing a limited number of import shipments from the United States through its New York correspondents, but only for the accommodation of old clients, and usually at terms not to exceed 30 days. Deposits are accepted by banks up to limited amounts, and in some cases a charge of 1% is made for the privilege, the banks having neither the opportunity nor the desire to invest money entrusted to their keeping. The usual loan and discount features of the banking business are not handled, and the interest on such call loans as are made ranges from 2 to 5% per month. The losses and uncertainties caused by the various revolutions have caused the banks to do business on a day-to-day basis, operations being conducted in such a way that if these institutions were obliged to liquidate their deposits, they would be able to do so at short notice and at minimum loss.

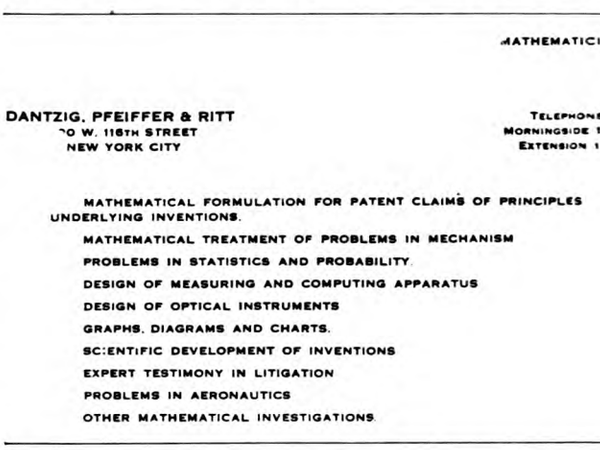
The result of this condition has been that American trade with Mexico has for some time been, with few exceptions, on a cash basis. American commission merchants and manufacturers' agents and representatives have called for a partial payment in cash on the invoice value of import orders, the remainder usually covered by sight draft against documents.

The most serious obstacle to be overcome in the resumption of trade is the lack of transportation facilities, as there has been no adequate upkeep of railway lines and equipment. For reliable service, shippers are dependent upon private trains. From the American border to San Luis Potosi, a distance of 475 miles, freight coming by private trains takes about ten days. By the regular Government service it takes from one to three months. Shippers by private trains pay the regular Government rate and 50% additional. Freight is not received on private trains in less than carload lots. Another serious handicap to trade is the fact that American railroads are afraid to allow their cars to be through-routed to Mexican points, thus compelling expensive re-loading at the border into cars of the Mexican National Railways.

On the West Coast a large part of the trade is done with San Francisco and Los Angeles jobbers. Previous to the War, German and Spanish importers had a large share of the import and export business. Since the War, the large Spanish houses have done a profitable business. There are also a number of Chinese firms in Mazatlan, Guaymas, Magdalena, and Manzanillo, which have taken a great part of the trade formerly done by German houses.

Unusual Index-Card

The original of the card-index card reproduced herewith is the standard 3 by 5 in. size used for most files. The thumb-index, 'Mathematicians', permits quick filing and reference. Other firms, of both professional and business men, might well adopt this method of ensuring a place in the filing-cabinets of possible clients. The announcement is also notable in that, so far as we know, it marks the first time that mathematicians have formally entered the industrial world, yet the card itself shows many ways in which the firm could be of use to industrial concerns. It might be added that, in spite of their names, none of the firm are 'enemy aliens', two of them even serving on the technical staff of the Ordnance Department during the War.



MATHEMATICIANS

DANTZIG, PFEIFFER & RITT
70 W. 116TH STREET
NEW YORK CITY

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MATHEMATICAL FORMULATION FOR PATENT CLAIMS OF PRINCIPLES UNDERLYING INVENTIONS.
MATHEMATICAL TREATMENT OF PROBLEMS IN MECHANISM
PROBLEMS IN STATISTICS AND PROBABILITY
DESIGN OF MEASURING AND COMPUTING APPARATUS
DESIGN OF OPTICAL INSTRUMENTS
GRAPHS, DIAGRAMS AND CHARTS.
SCIENTIFIC DEVELOPMENT OF INVENTIONS
EXPERT TESTIMONY IN LITIGATION
PROBLEMS IN AERONAUTICS
OTHER MATHEMATICAL INVESTIGATIONS.

A SERGEANT was so much given to using bad language on the parade-ground that some of the men complained and the C. O. interviewed him, and told him not to let it happen again.

The following morning the sergeant was in charge of a very ragged squad, and after keeping silence for a considerable time, he eventually burst out with:

"Bless you, my pretty dears; you know what I mean."

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The Quantity Manufacture of Mine Cars

IT seems to have fallen to the lot of the Joshua Hendy Iron Works to devise ways and means of producing a superior mine-car at relatively low cost through the application of quantity-production methods. Volume of product is, of course, necessary; jigs equally so, and more than either, careful study and experiment by which the many special tools and devices were painstakingly developed, not in a day or a week, but after many months of hard work.

The Matteson car might be called a 'feature' car, for the reason that practically all possible refinements in design, even to the smallest details that time and experience have shown to be desirable, have been embodied therein by the manufacturers. The body has a patented

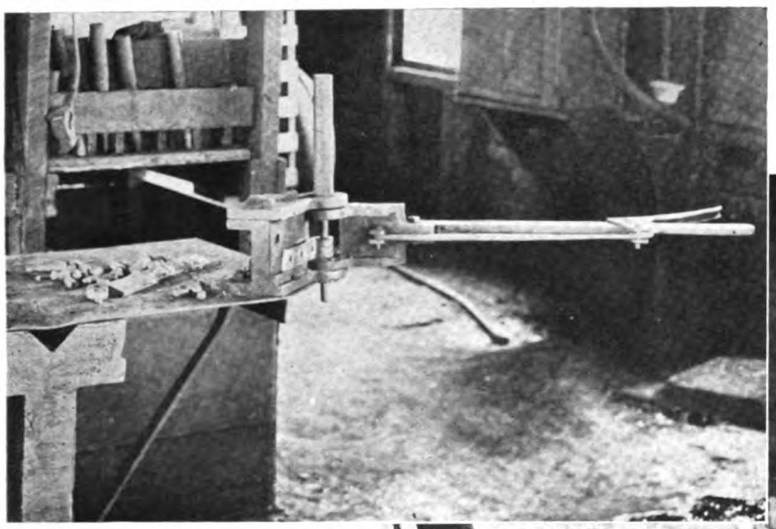

FIG. 2. SPECIAL TOOL FOR FORMING DUMPING-HINGES

two-stage dumping-hinge, a decided improvement over the old single-point dump found in conventional mine-car design. The axles are encased in dust-proof housing; the wheels may be equipped with Hyatt bearings if so desired; the swivels revolve on roller bearings, and the doors have an automatic release for dumping. It is only through quantity production, and the careful elimination of superfluous expenditure of labor that such a car can be turned out at the prices mine-owners have been accustomed to pay for cars.

This article presents a pictorial study of the methods of manufacture, with a brief description of the special tools developed by the Hendy engineering staff, and forms another exhibit of the result of enterprise and initiative as found in Western manufacturing establishments.

In order both to eliminate waste and to avoid superfluous riveted joints, the plates for the car-sides are brought from the mills cut to size except for the bevel at the open or discharge-end. Thus, the two sides and the closed end are in one piece. Before shaping, the rivet-holes are punched in multiples using a template and a Cleveland multiple punch and shear, the latter cutting the bevels at the discharge-end. This work done, the plate is put through the bending-roll, Fig. 1, which is hand-operated. This shapes the body in a remarkably short time. The angles and flats used for the joints and reinforcement are also bent in

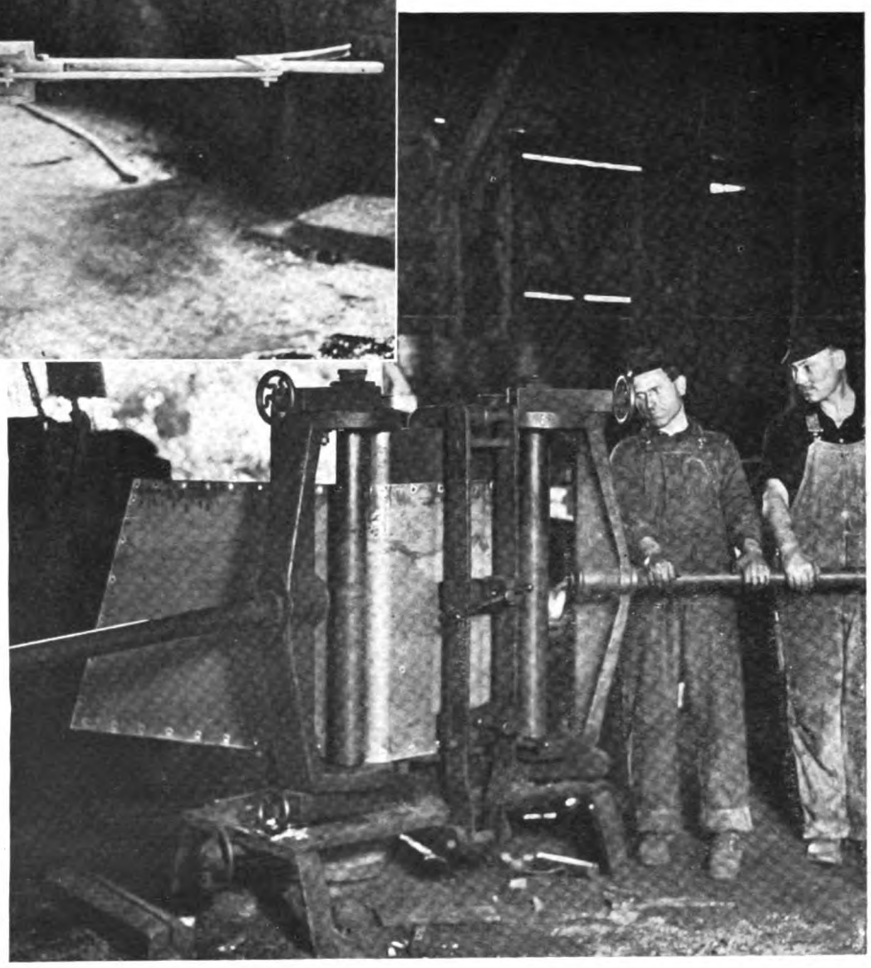

FIG. 1. BENDING-ROLL FOR SHAPING CAR BODIES

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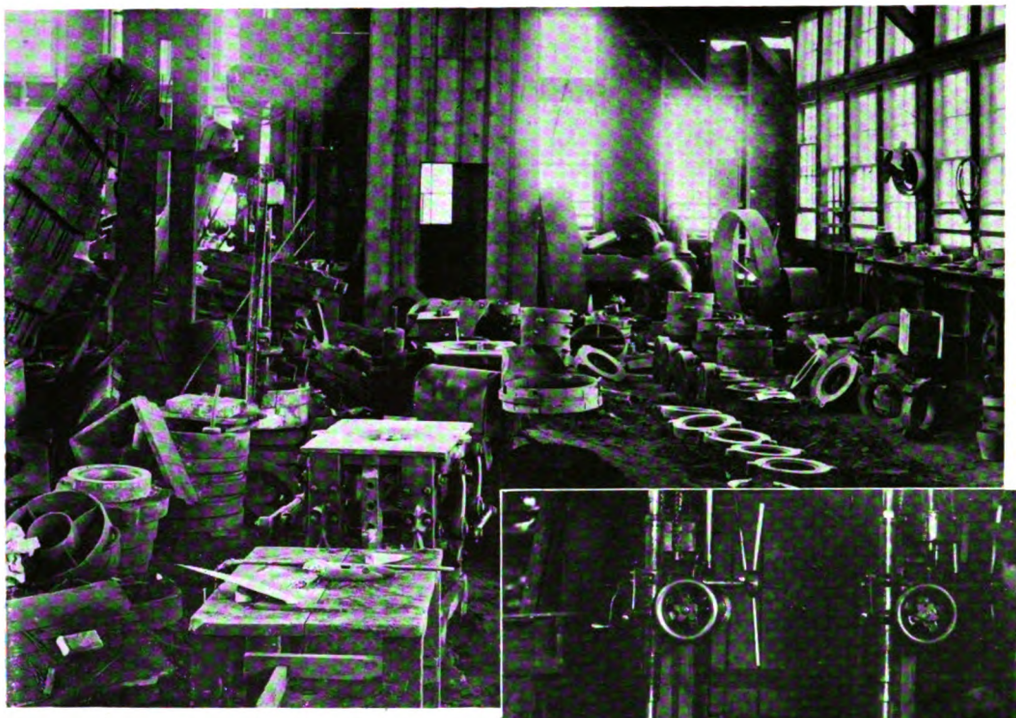

FIG. 3. CAR-WHEEL DIVISION OF FOUNDRY

the same contrivance through the use of a groove in the inner roller, permitting the angle-iron to be bent and shaped on flat rolls.

Fig. 2 shows a special tool for forming the dumping-hinges. These hinges are made of flat steel. The pieces, after being cut to length, are placed one at a time against the anvil. A mandrel suitable for any size bolt is dropped in place, the latch is dropped down by pressure of the fingers, and a 180° turn is made of the hand-lever. Thus the end of the strap-iron is bent completely around the mandrel and the hinges. The bending is done hot. A similar tool has been devised for making rectangular bends on flat steel.

Fig. 3 shows the car-wheel division of the Hendy foundry. In the foregoing are two jarring machines for ramming the wheel-molds. To the right of the jarring machines are shown the heavy cast-iron chills by which the wheel-treads are chilled for a distance of about one-third of their thickness. The design of chills is not an exact science under the most favorable circumstances, and much time was spent in experimenting before thoroughly satisfactory chills were devised. There is a definite relationship between the amount of metal in the wheel and the design of the chill. Too light a wheel will chill the rims for too great a depth and make them brittle. If too much metal is used in the wheel-rim the chill will not penetrate to sufficient depth to make a satisfactory tread from the standpoint of wearing quality. The wheels are annealed in an open-pit furnace in order to reduce any internal stresses and to prevent cracking.

Fig. 4 shows a battery of drill presses used for boring the car-wheels. One man operates two presses, setting one wheel in a self-centring chuck on one press, while another wheel is being bored on the second press.

Fig. 5 shows the matchboard patterns used for the axle-housings. As indicated the axle-housings are molded four in a flask, the ramming being done by jarring-machines. The machine work for finishing is done on a lathe with a single cut of the boring-tool, as is shown in Fig. 6. The car trucks are made in one piece of channel-steel, which is bent hot around the forming-die. The axle-housings are fastened to the frame by U-bolts extending through drilled holes in the channel. The same bolts are made long enough to fasten the turntable to the frame. U-grooves are cast in the axle-housings to prevent the bolts from slipping. There is no external machine work on the axle-housings. The turntable is made of cast-iron, top and bottom, and no machine work is required, the castings being made smooth to revolve on beveled rollers, which also are smooth-cast and not machined. Assembling the car is a comparatively simple task. All holes are drilled and punched with templates. There is no need of experimental fitting or of trial-and-error-methods.

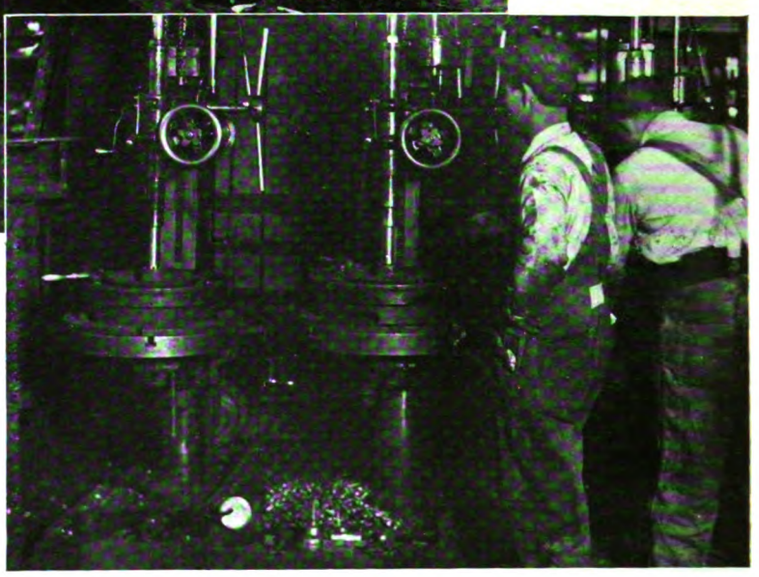

FIG. 4. DRILL-PRESSES FOR BORING CAR-WHEELS

The Hockus Pockus Iron Works is running nights on a large ship-order in hopes of getting it finished before the cancellation comes in.

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Placing the Injured Workman Back Into Industry

"In our district, when a man is permanently injured so badly that he cannot resume his former occupation, other employment is found for him at the plant. He is not given this job as a charity job, but the fact is impressed upon him that he is perfectly able to earn a competency at the work given him and it is a pleasure for the management to be able to give him some occupation at which he is capable of doing as well as the man who has no physical disability. If these ideas and practices, which are new in this State, are carried forward as they should be, we feel that we will have happier, more contented, and certainly more efficient, workmen."—Clarence Parker, Safety Engineer for the Employers of Everett, Washington.

"Indeed it has often been found that by reason of the necessity of placing the injured man into some employment for which he is peculiarly suited, the man becomes really more efficient than he was before he received his injury. What England and France are doing for their crippled soldiers demonstrates the possibilities of the very practical and splendid thing that Mr. Parker has in mind. The most marvelous things are being done in these countries to put their wounded soldiers back into a place in life; and men who have been so terribly crippled that in other days they would have been considered hopelessly disabled, are actually being so thoroughly rehabilitated that they are sometimes made really more capable than they were before they received their injuries, for the reason that the training and education they receive develops latent powers and brings them into better and more efficient fields of work and opportunity.

"Bringing these men back into industry, instead of allowing them to become pensioners, would result in a vast reduction in the cost of industrial insurance.—Report, 1918, of the Industrial Insurance and Medical Aid Departments of the State of Washington.

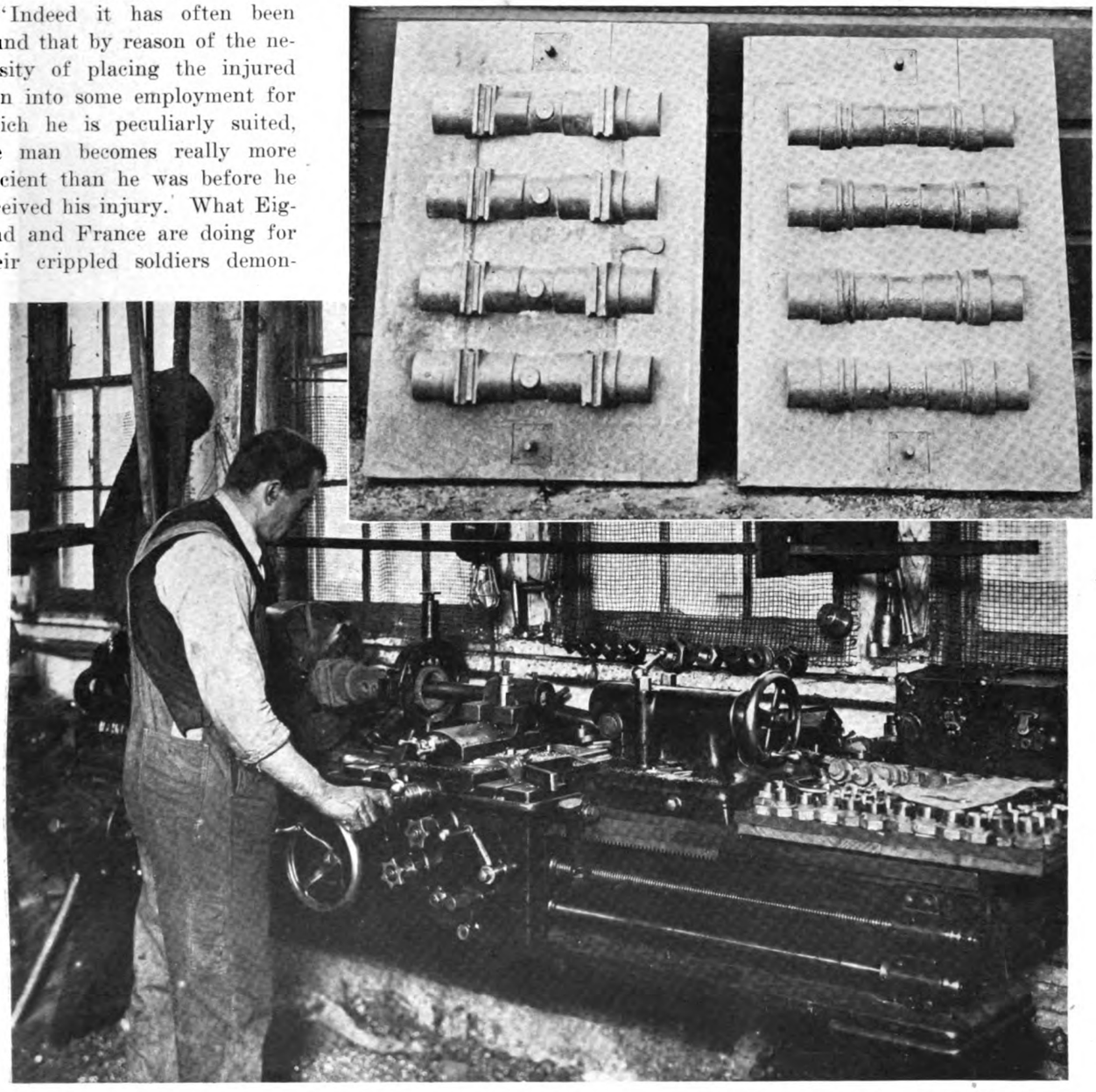

FIG. 5. MATCH-BOARD PATTERNS FOR AXLE-HOUSINGS

FIG. 6. MACHINING AXLE-HOUSINGS

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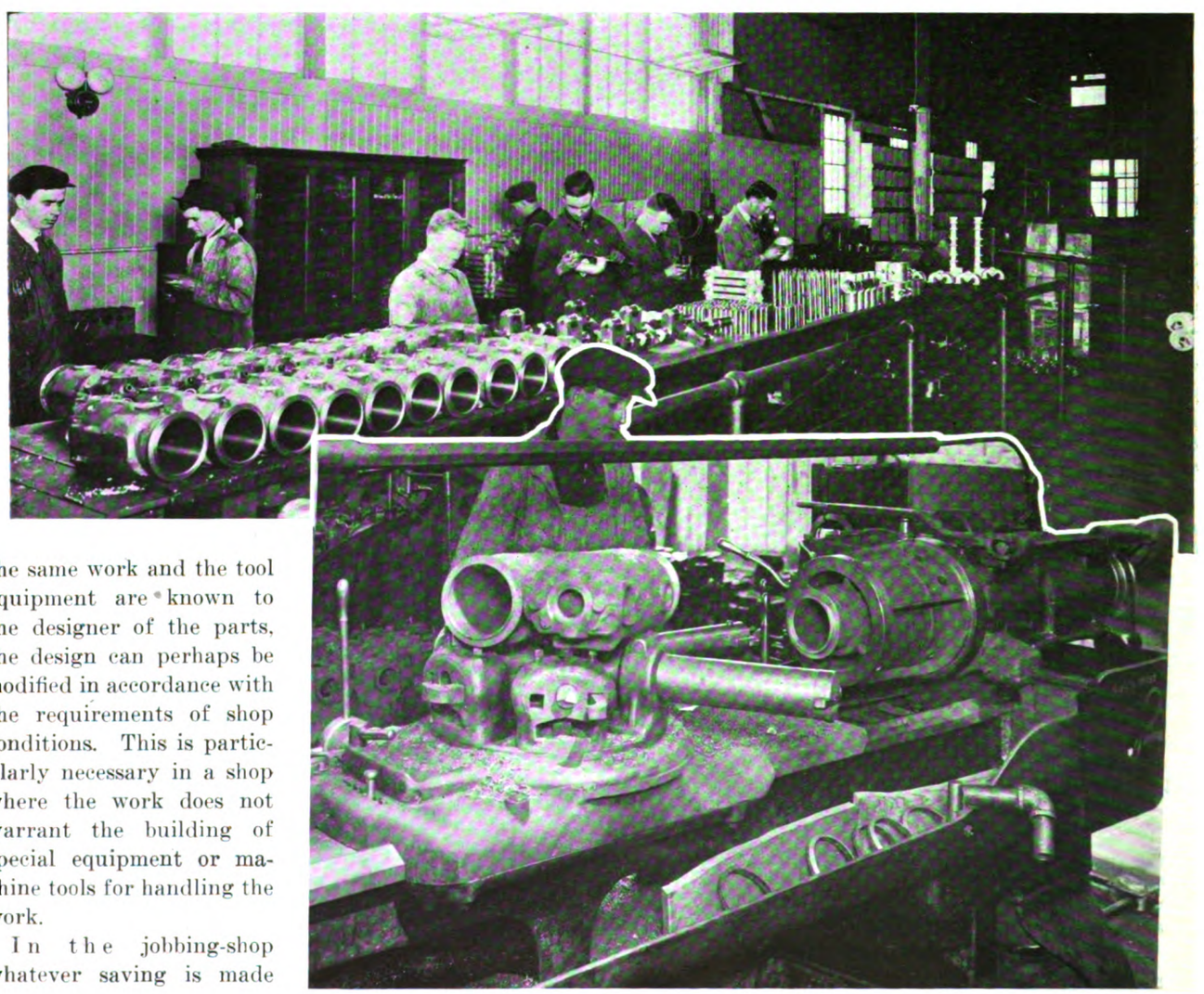
Machining Operations on Cast Iron Cylinders

By RICHARD VOSBRINK

MACHINE-SHOP operators interested in quantity production as well as mechanics, foremen, and those responsible for the economical duplication of parts are alive to the fact that industrial conditions, competition and other factors, make it necessary to plan the work in the shop for any particular part so that there will be as little time lost as possible in moving the raw material, in setting up the work, and in performing the necessary operations required to complete a finished part. Considerable time can be saved and production costs reduced if shop conditions are considered. If the possibilities of various methods of doing the same work and the tool equipment are known to the designer of the parts, the design can perhaps be modified in accordance with the requirements of shop conditions. This is particularly necessary in a shop where the work does not warrant the building of special equipment or machine tools for handling the work.

In the jobbing-shop whatever saving is made must be accomplished entirely in the machining processes. Successful operation of course necessitates rapid production combined with accuracy, as the work must be held to limits or tolerance dimensions to provide for interchangeability. The development of machine tools is along the lines of specialization and maximum production to attain this saving.

The manager of a shop equipped with up-to-date machine tools should acquaint himself with the characteristics of every tool, its possibilities in production or capacity for work; efforts should be made to bring its production capacity up to the recommendations of the



ABOVE, INSPECTION OF CYLINDERS. BELOW, MACHINING CYLINDERS ON TURRET-LATHE

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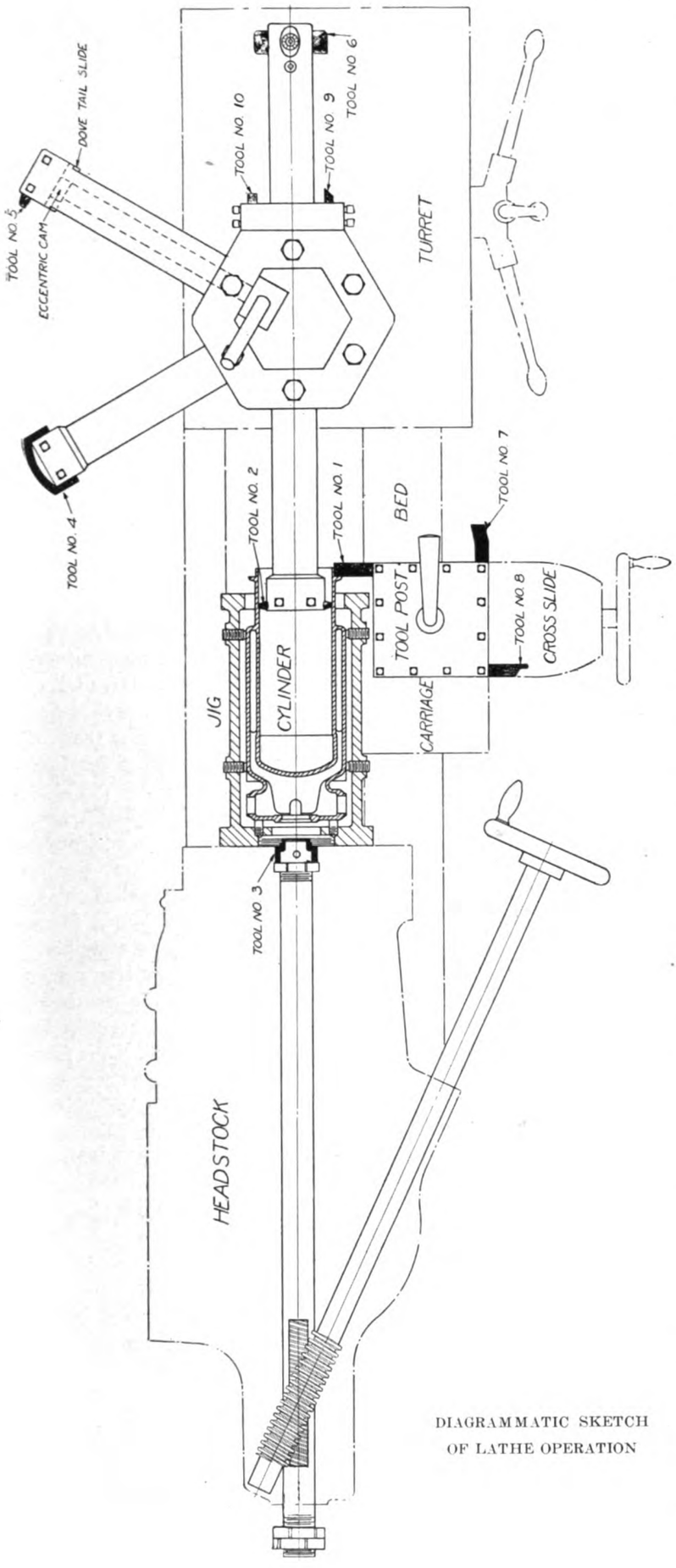

DIAGRAMMATIC SKETCH OF LATHE OPERATION

manufacturers of the machine. To do this necessitates in many instances the making of special fixtures and jigs for holding the work, and special tools for performing the operations.

Prior to, and during the War, the Hall-Scott Motor Car Co. was producing aeroplane-engines in considerable quantities. In the construction of these engines a large number of small parts were needed, which required careful fabrication to ensure the necessary accuracy and other characteristics essential to the class of work entering into the finished product. Among these parts, the cast-iron cylinders occasioned considerable thought and the methods developed for handling this part should be of interest to any one concerned in quantity production.

To simplify the description of the process, it is diagrammatically illustrated herewith so that the sequence of operations can be readily followed:

To begin with, two 18-in. Libby turret-lathes were employed for the work. Suitable jigs or holding fixtures were made, so designed that the cylinders could be inserted and clamped in position by means of adjusting-screws, and as readily detached and removed, care being exercised to maintain concentricity of the work. The boring-bars in the turret were arranged with tools attached thereto so that they could be operated in conjunction with other tools arranged on the tool-post for the cross-feed.

The first operation consists of rough-turning the diameter of the pilot or lower end of the cylinder, together with the bottom-side of the base-flange. This is fed-in on the cross-slide against a stop. (See tool No. 1 in the sketch). For some work the position of the tool-post as illustrated would require a rather long tool. To get it closer to the work the tools could, if necessary, be so arranged that the tool-post would be between the fixture and the turret. While tool No. 1 is doing its work, tool No. 2 can be feeding into the cylinder. This is a rough-boring operation. The feeds and speeds for different work have to be determined experimentally to secure the best results. For the cylinder in question, a roughing and finishing boring-cut was found to be most advantageous, the tool being fed-in at the rate of $\frac{1}{8}$ in. per revolution of the cylinder. During the time that operations No. 1 and No. 2 are taking place, tool No. 3 can be fed-in through the headstock by hand. This tool performs a counterboring and facing operation on the top of the cylinder.

These operations being performed, the ma-

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chine is tripped back and tool No. 4 swung into place. This is for finish-boring the sides and the crown of the cylinder-head. Tool No. 5 is arranged for counterboring the cylinder-head. Since this counterbore is larger in diameter than the cylinder-bore, through which the bar passes, an arrangement for expanding the tool is required. This is accomplished by an eccentric-cam arrangement, integral with the boring-bar, and actuated by a hand-lever.

This operation having been completed, tool No. 6 can be swung into position. This is a finish-reaming tool. It has been found practical to feed this in at the rate of ¼ in. per revolution of the cylinder. Whlie the reaming is going on, the tool-post can be swung around to tool No. 7, which finish-turns the pilot and faces the flange on the cylinder.

Tool No. 8 is a forming tool facing the back contour of the above-mentioned flange. After the reaming-tool No. 6 has gone the length of the cylinder, it brings into operation tool No. 9, which provides a small chamber in the bottom of the cylinder. At the same time tool No. 10 cuts the pilot to length, thus completing all the work done on the cylinder in this particular machine.

The stops and trips on the machine are set so that the various functions are practically automatic. An inexperienced operator soon becomes proficient on a machine of this kind provided there is a sufficient amount of work.

Variations and modifications of these set-ups and operations will be readily apparent to the machine operator. Different arrangements can be determined to suit the various kinds of work on which this machine can be conveniently employed. Satisfactory results were obtained by the Hall-Scott Motor Car Co. in performing the turret-lathe work on its cylinders as outlined in this article.

Skin Diseases From Certain Lubricants*

By CHARLES BASKERVILLE

The British Department of Scientific and Industrial Research has published some results of studies of oil-rashes. These appear to be caused, first, by plugging small glands at hair-roots, especially on workers' arms and legs, and, second, by mechanical injury to the skin from metallic particles suspended in the cutting lubricant.

In the first type, the oil and dirt blocks the openings of the glands, causing inflammation, which may lead to suppuration and even abscesses. In the second type, the abrasion of the skin favors infection.

Liberal washing and dusting of parts with a compound of equal parts of starch and zinc oxide are recommended. It is best to avoid conditions favorable to the formation of free fatty acids, and to remove metal particles and to clean the machines requently. Machines should be examined regularly. Workers affected should not operate machines, as they are likely to spread infection. The addition of antiseptics, such as a 1 or 2% solution of carbolic acid, to the cutting compound, was tried, but was found to be unreliable. The best treatment is frequent washing with hot water and soap, and in case of septic infection, the application of antiseptic dressings.

My own experience, confirmed by many reports of accidents and infections, prompts me to recommend regular washing with a soap containing pine oil. This not only cleanses the surfaces, but renders them, for the time being, sterile. Such compositions must not be applied to the eyes, or taken internally.

*Abstract from 'Journal of Industrial and Engineering Chemistry'.

Iron Production in China and Chosen

The Taoshung mine, containing 20,000,000 to 30,000,000 tons of ore, is connected with Chikiangchen, on the Yangtze river, by rail, and supplies the Oriental Ironworks Co. with iron ore. The wages of coolies are 15 cents per day. The expenses per ton down to the port of Chikiangchen are $2, but there is a margin for further economies.

The Taiyeh mine contains about 100,000,000 tons of ore. It will supply the Japanese government ironworks at Yawata, Kiushu, with 600,000 tons of ore per year, beginning in 1920. The amount to be supplied this year is 350,000 tons, at $1.89 per ton. Two 450-ton furnaces are being built near the mine in order to supply the Yawata ironworks with 200,000 tons of pig-iron per year.

At the Anshanchan Iron Works of the South Manchuria Railway Co. two 250-ton furnaces are now being built, which will be ready for use in April. It is further proposed to construct 12 to 16 more furnaces of the same type in course of time and produce 1,000,000 tons per annum. Ore in the neighborhood, containing 40% and over of iron, is said to amount to 400,000,000 tons.

The Penchihfu Coal & Iron Co. has two 130-ton furnaces and two 20-ton furnaces and produces about 100,000 tons per year. It is a promising concern, commanding as it does an abundant supply of coal suitable for the production of coke.

The Chienerhpu Iron Works in Chosen has two 150-ton furnaces and produces an annual amount of 100,000 tons, which is converted into 50,000 tons of steel.

The Hanyang Iron Works has built two 110-ton furnaces and is now erecting two 250-ton furnaces, one of which is nearly completed.

In short, the production of iron in China this year is expected to amount to 576,000 tons, and it will probably reach 936,000 tons next year.

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Trade With the West Coast of South America

A circular recently issued by the Latin American Division of the U. S. Bureau of Foreign and Domestic Commerce discusses trade conditions on the West Coast of South America. At the beginning of the War, Great Britain was first among the countries supplying these markets, with Germany second, and the United States third. As a result of disturbance of old trade channels, the United States is now first, with Great Britain second, and Germany, temporarily at least, out of the race. Japan, whose exports to these countries were negligible before the War, has now gained a foothold.

The West Coast markets consist of a series of isolated communities, on or near the seacoast, which extend from tropical Buenaventura to bleak Punta Arenas. These communities are centres of either mining or agricultural regions, a large proportion of whose population is Indian, with a limited purchasing power. There is no continuous railway from north to south, and with the exception of the trans-Andean line, no railway crosses the continent. Hence, the Pacific Ocean is the chief avenue of traffic from north to south and the only means of access to the region west of the Andes.

The principal ports of Chile, listed from north to south are Iquique, Tocopilla, Antofagasta, Taltal, Caldera, Coquimbo, Valparaiso, Talcahuano, Coronel, and Punta Arenas. The chief commercial centres are Valparaiso and Santiago. Nitrate is the leading export of the country, followed by copper and other minerals. Among the principal imports are mining and agricultural machinery, railway equipment, and automobiles.

In Peru, the principal ports are Callao and Mollendo. Paita, Eten, Salaverry, and Pisco are of secondary importance. Lima and Arequipa are the chief commercial centres. Among the principal imports are mining and oil-well machinery, machinery for sugar and cotton plantations, and railway equipment.

Bolivia has no seaports of its own, the principal trade being carried on through Mollendo, Arica, Mejillones, and Antofagasta, with which ports there are rail connections. The chief cities are La Paz, Cochabamba, Sucre, Potosi, Oruro, and Santa Cruz. Mining is the principal industry of the country, tin being the most important product, followed by copper, silver, tungsten, and antimony. Various kinds of machinery and manufactured articles are imported.

Quito is the chief city in Ecuador and Guayaquil is the chief port. Cacao is the principal article exported, and machinery and hardware are among the leading imports.

Most of the trade of Colombia goes through its Caribbean ports, and is therefore not included in this article. However, there is one Pacific port, Buenaventura, which exported articles valued at $4,741,793 in 1917, and imported goods valued at $2,636,755. Coffee is the principal export and metal products of various kinds are among the leading imports.

The value of imports from the United States to West Coast countries increased from $33,015,000 in 1913 to $71,865,700 in 1917. The 1917 exports were divided as shown in the table below.

The readjustment of commerce to normal conditions must necessarily be a slow process. During the past few months of suspense exporters have been waiting until more tonnage should be released from war uses in the hope that freight rates might then be lowered. Importers need supplies of all kinds but are holding off anticipating a decline in prices. As soon as conditions become sufficiently normal, however, we shall find ourselves once more in the midst of the fight for commercial supremacy. It is not going to be easy to hold the large share of the West Coast trade which we have gained during the War, and it is well not to ignore the difficul-

Commodities	Total	To Chile	To Peru	To Bolivia	To Ecuador
Cotton, manufactured	$9,251,715	$4,489,399	$2,584,311	$855,604	$1,322,401
Machinery and parts (of iron and steel)	5,756,836	3,820,157	1,555,339	169,572	211,768
Oils, mineral	4,874,613	4,415,930	247,838	122,516	88,329
Wire, manufactured	3,289,124	2,382,575	669,978	82,305	154,266
Breadstuffs	3,228,240	1,009,359	1,554,275	193,423	471,183
Drugs, dyes, and chemicals	3,175,016	1,983,272	892,272	56,890	242,582
Explosives	3,157,696	2,245,915	695,710	150,585	65,486
Coal and coke	2,884,530	2,153,399	638,717	7,965	84,449
Automobiles and parts	2,884,028	2,230,581	371,666	160,605	121,176
Iron and steel, partly manufactured	2,568,537	1,926,134	490,039	43,304	109,060
Electrical machinery, appliances, and instruments	2,308,960	1,796,059	372,398	28,695	111,808
Paper and manufactures of	2,182,169	1,188,139	694,181	66,405	293,444
Leather and manufactures of	2,156,452	1,132,412	698,020	80,149	245,871
Wood and manufactures of	1,858,400	781,420	857,835	39,805	179,340
Steel rails and track material	1,312,950	937,180	331,351	15,006	29,413
Iron pipes and fittings	1,133,510	553,666	544,700	16,886	18,258
All other	19,842,924	11,357,505	5,475,427	782,164	2,167,828
Total domestic exports	$71,865,700	$44,403,102	$18,674,057	$2,871,879	$5,916,662

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ties. Great Britain has endeavored to hold as much as possible of its trade even during the War; she has studied the market and is used to catering to it; and her investments in the West Coast countries still outrank ours. Germany will attempt by every means in her power to regain a share of the trade. Japan intends to follow up her war trade, and hopes to make it permanent; and since Japan is becoming a manufacturing nation she will need the raw materials which the West Coast countries have to export, and will have manufactured products to sell in return.

On the other hand, we have several factors in our favor. In other words, we have developed our manufacturing industries and are more anxious than formerly to import the raw materials that the West Coast countries have to sell. Conversely, we have more manufactured products to sell in the West Coast markets. Our investments in the West Coast countries are rapidly increasing. Furthermore, the recent establishment of American banks in West Coast cities will tend to place American exporters on a par with European exporters in all the details relating to the important matter of credit.

Gear-Steels

In a paper read at the annual convention of the American Gear Manufacturers' Association, J. H. Parker, metallurgist for the Carpenter Steel Co. discussed gear-steels with special reference to those used for automotive work. Steels for this work are divided into two classes, casehardened gears and tempered gears. In general, steels of the first class should be used for constant-mesh service, and of the second class for change-gear or clash-gear service. When a casehardened gear is used for clash-gear service, there is danger of chipping and consequently exposure of the soft core. Table I shows the characteristics of the principle types of casehardened gear-steels. The first three types are in general use, while the other three, on account of their higher cost, are used less extensively. All these steels contain the same proportion of silicon, 0.20%. The first four contain the same proportion of sulphur and phosphorus, 0.04% each, while in the other two, both the sulphur and the phosphorus are held to 0.03%.

Carburized pieces should not be quenched directly from the carburizing-box, unless a hard surface with no special strength or toughness in the core is the only thing desired. Double quenching is recommended for the best results. Table II gives the characteristics of the principal types of steel for tempered gears, the first two being the most commonly used. The following proportions of other substances are uniform for all four types, silicon, 0.20%; sulphur 0.03%; phosphorus, 0.03%; and manganese, 0.40%.

The Iron Industry in 1918

Final statistics of production of iron ore for 1918 are now available. The total amount mined was 69,658,278 tons, a considerable decrease from the 75,288,851 tons mined in 1917. Of the 1918 production, 59,779,794 tons came from the Lake Superior district in Minnesota, Michigan, and Wisconsin, and 5,107,389 tons from the Birmingham district. No other single district produced as much as 1,000,000 tons. Pig-iron production including ferro-alloys in the two years was more nearly uniform, the total in 1917 being 38,621,216 tons and in 1918, 39,054,644 tons. The production of steel in 1918 was 44,462,432 tons, of which 34,459,391 tons was open-hearth, 9,376,236 tons was bessemer, and 626,805 tons was either electric or crucible steel. All the figures given above are in gross tons.

PRIVATE DOE stood before a court-martial on a charge of assault.

"Why did you strike this man?" said the judge-advocate.

"Well," said the private, "the reason I walloped that there civilian was I didn't mind when he took my best girl into the conservatory and made love to her, and even when he tried to kiss her, but it sure got me sore when he started fanning her with his exemption card."

"Case dismissed," said the president of the court.

Table I

Chemical and Physical Properties of the Core of Casehardened Gear-Steel

Name	C. %	Mn. %	Cr. %	Ni. %	Elastic limit, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elongation in 2 in., %	Reduction of area, %	Scleroscope	Scleroscope of case
Simple carbon	0.20	0.50	...	...	50,000	75,000	20	55	30	90
Mild chrome-nickel	0.20	0.60	0.40	1.25	100,000	150,000	12	46	40	90
3½% nickel	0.20	0.60	...	3.50	105,000	160,000	13	45	50	90
5% nickel	0.15	0.40	...	4.75	125,000	175,000	15	50	54	90
Medium chrome-nickel	0.17	0.40	1.00	1.75	140,000	180,000	13	50	58	90
High chrome-nickel	0.12	0.40	1.25	4.00	150,000	200,000	13	52	60	90

Table II

Analysis and Physical Properties of Steels for Tempered Gears

Name	C. %	Cr. %	Ni. %	Elastic limit, lb. per sq. in.	Tensile strength, lb. per sq. in.	Elongation in 2 in., %	Reduction of area, %	Scleroscope
Medium chrome-nickel, Type A	0.50	1.00	1.75	260,000	300,000	6	16	76
Mild chrome-nickel, Type B	0.50	0.70	3.00	235,000	260,000	7	18	74
High chrome-nickel	0.40	1.25	3.50	250,000	285,000	6	18	76
Air-hardening chrome-nickel	0.30	1.50	4.50	220,000	255,000	9	22	70

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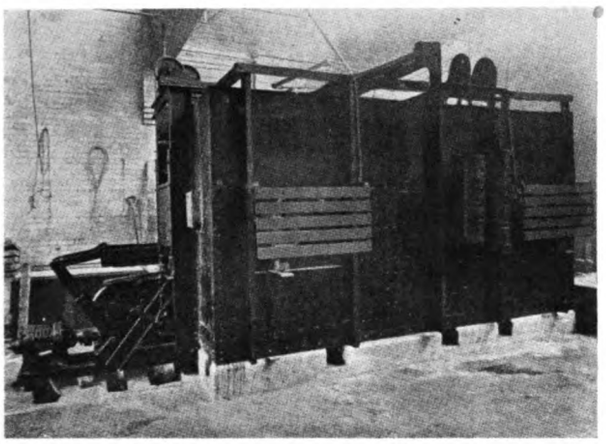
Baily Electric Furnaces for Soaking, Annealing, and Heat Treating

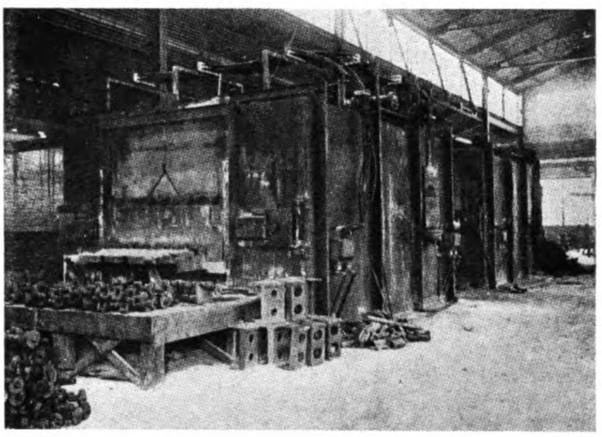
THE use of electric furnaces for various types of heat-treatment has been a matter of gradual development, retarded by natural conservatism, but a sufficient number are now in use to demonstrate their feasibility. While the cost for fuel, or rather power, with an electric furnace is usually greater than for a fuel-fired furnace, there is, on the other hand to be considered the saving of labor, the greater precision, and the virtual elimination of rejections of parts because of defective heat treatment. There is often a wide difference between cost per ton of material put through a furnace and cost per ton of material properly heat treated and conforming to specifications. This was particularly true during the War, when many companies engaged on war orders lost heavily for a while because of rejections of material. Some of the most notable examples of articles heat treated in electric furnaces are the following: The crank-shafts for the Liberty motors, over half of which were so treated. The cast-steel anchor-chain for the Emergency Fleet Corporation, all of which was so treated. Railroad draw-bar knuckles, about half of the present output being so treated.

An important field for the electric furnace is for 'soaking' hot ingots and for re-heating hot blooms and billets. The advantages obtained by better control of the heat and the elimination of the loss from scale more than compensate for the slight extra cost of power as compared with that of the fuel used in a fuel-fired furnace. When heating cold blooms and billets, however, it is better to use a fuel-fired furnace to bring the material to say, 1800°F., and then to complete the heating in the electric furnace.

Among annealing furnaces, the recuperative-car type will probably have the widest application. Two furnaces of this type have recently been constructed, one for cold-rolled strip steel and sheets, and one for alloy-steel bars. The first furnace has a capacity of 150 tons of material per day. It is 22 by 225 ft. long. The electrical capacity is 600 kw. The material is handled on sand-sealed cars, each car holding 20 tons. In all there are 17 cars on each of the two tracks passing through the furnace, each line of cars passing in opposite directions. In the middle of the furnace is the heating-chamber proper, which is 26 ft. long and holds two cars in the heating-zone on each train at a time or about 80 tons of material. A movement of the cars takes place on each track every six hours, discharging a 20-ton car of material from each track and also charging a car on each track.



150-KILOWATT PUSHER-TYPE FURNACE FOR HEAT-TREATING AEROPLANE PARTS



900-KILOWATT AUTOMATIC TWO-FURNACE EQUIPMENT FOR HEAT-TREATING AEROPLANE CRANK-SHAFTS

However, the most important application of electric heating furnaces is for regular heat treating where two furnaces are employed, one for the hardening temperature and one for the drawing temperature, together with a quenching mechanism between the two.

A Baily furnace of this type was constructed last year for heat treating crank-shafts for Liberty motors. Because of the irregular shape of the material under treatment, and also to enable other sizes and types of aeroplane shafts to be handled interchangeably, a special type of cast-steel chair was developed so that the direct force of the pushers was brought against a line of these chairs, the material to be heated thus lying independent and free from strain while going through the furnace. The specifications for these shafts were unusually exact-

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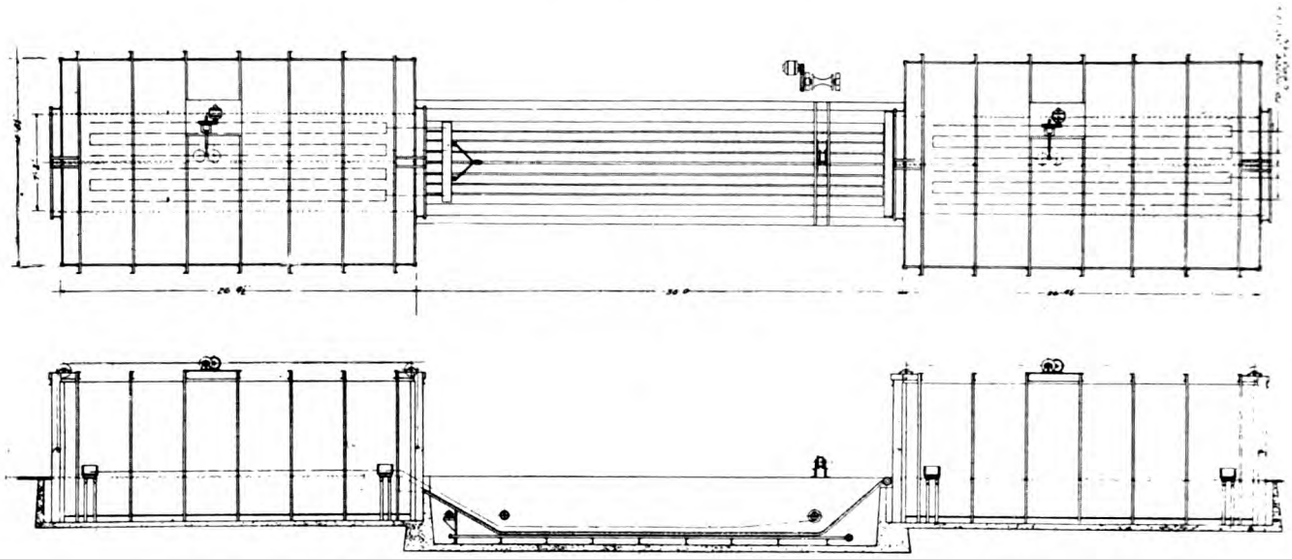


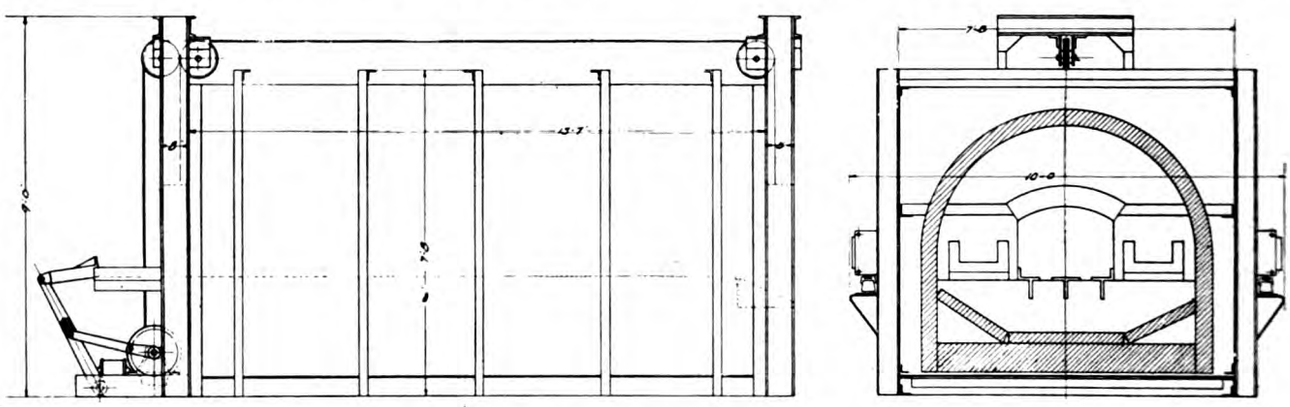
CONTINUOUS TWO-FURNACE EQUIPMENT FOR HEAT-TREATING CAST-STEEL ANCHOR-CHAIN

ing, and test-pieces were taken from each end of every piece, nevertheless, for days at a time, there would be no rejections from an output of several hundred shafts per day. The entire equipment for handling the material through the two furnaces and the quenching-bath is automatic. The current consumption when operating at capacity is 300 kw-hr. per ton of material treated.

Another furnace of this type was constructed at the plant of the National Malleable Castings Co., Cleveland, for treating cast-steel anchor-chain. When the program of the Emergency Fleet Corporation was announced, it was computed that more than 225 miles of anchor-chain would be required for the Corporation's vessels alone, without counting the needs of the Navy or of private owners. If this chain had been forged, it would have taxed the entire capacity of the shops of the country for many years. For this reason, the chain was cast, and was then heat treated in an electric furnace. The outfit consists of a 600 kw. hardening-furnace, approximately 16 by 28 ft. long, with a hearth 6 ft. 6 in. wide extending the length of the furnace. At the discharge-end of the furnace is a concrete quenching-tank 8 by 40 ft. long for quenching the chain. At the other end is a furnace of similar size, but 300-kw. capacity, for drawing the chain after quenching. Each furnace has a rated capacity of 50 tons of chain per day, and the current consumption when operating at capacity is 450 kw-hr. per ton, being higher than for the crank-shaft furnace because a larger furnace-chamber is needed for the same capacity.

The charge consists of two 90-ft. lengths of 2-in. cast-steel chain, folded into loops 22 ft. long. These loops are dropped over heavy cast-steel hooks, the ends of which, when the charge is in the furnace, protrude through recesses cut in the furnace-door. The ends of these hooks are connected to a heavy steel cross-bar, which is provided with lugs for attaching the pulling-chains, which are operated by a winch equipped with a 20-hp. motor.

The operation of heat treating these chains begins by dropping the loops of the folded chain over the hooks in front of the charging-end of the hardening-furnace; the hearth of the furnace being level with the foundry-floor. The pulling-chains are dragged through the hardening-furnace from the front end by means of an iron bar, the winding-drum backing off the chain as it is pulled through the furnace. These chains are now hooked to the



CONTINUOUS PUSHER-TYPE FURNACE FOR HEAT-TREATING SMALL AEROPLANE PARTS IN PANS. THIS CAN BE EQUIPPED WITH EITHER HAND OR AUTOMATIC CONTROL

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steel cross-bar of the cast-steel hooks already mentioned, the winch is reversed, and the chain is pulled into the hardening-furnace, where it remains for about two hours, during which time it is heated to the furnace temperature, about 1650°F. The doors of the hardening-furnace are then opened, and the winch pulls the chain into the quenching-pit, where it lies on a steel framework composed of 7-in. channels. As the chain is immersed in the quenching-bath, it is met by a strong flow of fresh water from submerged nozzles, so as to give it an initial chilling as soon as it is immersed.

As the tail-end of the chains passes out of the furnace-door, the door closes, and the chains are allowed to lie in the bath for several minutes. Before they are cooled completely, however, they are pulled into the second furnace by a similar mechanism to that already described.' The chains stay in the second furnace for two hours, and are then withdrawn.

Another interesting furnace is one at Erie, Pennsylvania, for the treatment of small aeroplane parts, particularly clevis-pins and bolts, some of which weigh less than an ounce. A notable feature of this furnace is the fact that the material is machined before treatment, making it necessary that there shall be no scale on the finished product, and also that a maximum of accuracy be attained in the heat treatment. The material is handled through the furnace in steel pans, and each pan moves forward in the line actuated by a motor-driven pusher, whose movements are interlocked with the door-mechanism, so that there is no lost time in charging, and consequently little free air enters the furnace.

While the electric heat-treating furnace is particularly well adapted to treating special alloy-steels, it is also suited to carbon-steels. Indeed a properly heat-treated carbon-steel is often superior to a more expensive alloy-steel that has not been so carefully heat-treated.

Baily furnaces for heat treatment are designed on the same principle as the Baily furnaces for brass melting described in the August issue of 'Metal Trades', the furnaces being of the resistance-type and the resistance elements consisting of broken carbon thrown loosely into a carborundum fire-sand trough along the outer wall of the pit. Besides those already mentioned in this article, Baily furnaces for heat treatment are used by the following companies:

Ingalls-Shepard Forging Co.,
National Malleable Castings Co.,
Erie Specialty Co.,
Euclid Glass Division,
Otis Elevator Co.,
Stavanger Electro-Staalverk,
U. S. Aluminum Co.,
Valley Steel Co.,
Pierce Arrow Motor Car Co.,
Wm. A. Rogers, Ltd.,
Braeburn Steel Co., and
Standard Roller Bearing Co.

The Pacific Coast agents are Gunn, Carle & Co., of San Francisco.

The German Iron Industry

By ARTHUR H. REDFIELD*

Although fuel shipments have improved, little increase has occurred in German iron and steel production. A number of concerns are still closed for lack of coal. The dearth of raw materials is felt in many places. The total production of all factories is now only a little more than 30% of the peace-time output, and it is improbable that there will be any perceptible change for a considerable period. Yet the large iron and steel mills, as well as the machine-factories and other related industries, could still give employment to many hundreds of workmen, if the workmen showed any desire to work. If the Government does not quickly institute regulations in favor of compulsory work, the manufacturers say, the situation of the German iron industry must become decidedly critical.

Export trade especially has to suffer under this state of affairs. Already extensive inquiries have been received from the neutral, and even the hitherto hostile countries. In Italy especially there appears to be a desire for entering once more into closer relations with the German iron industry as quickly as possible. But a great deal of important business has been lost for the German iron makers through the impossibility of delivering quickly. In prices also the German industry fails to meet American competition. American beams and bar irons are offered at 180 to 190 florins ($72.36 to $76.38) c.i.f. Rotterdam, while the German price is 500 florins ($201). It is not apparent whether this price refers to newly rolled material or iron from the demobilization. The important fact is that American steel makers are underselling German manufacturers on their own ground. American competition is also felt in the British steel market.

How far it will be possible to win back the export market through the quality of German manufactures depends naturally on the productive capacity of the factories. The question of raw materials, particularly ores, must first be solved. French owners of mines will deliver ores to Germany only at high prices. The prices of Swedish, Spanish, and other ores also, with the unfavorable state of exchange, will weigh heavily upon the cost of production. There is, however, a possibility of Germany's competing in the world market with low prices under certain conditions, but there remains even from this point of view some doubt whether the optimistic expectations which people in Germany are cherishing with regard to the development of the German iron market are justified. In this connection comes the competition from the French side, since France will not be able to consume at home the great quantities of iron that it can manufacture in the newly won territory, but will apply herself more than ever to exportation. Hence Germany is afraid of an invasion by the united Franco-Luxemburg-Belgian iron and steel mills.

*U. S. Trade Commissioner at The Hague.

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The Heat Treatment of High-Speed Steel*

By C. U. SCOTT†

No high-speed steel is ready to be hardened unless the steel is annealed; no high-speed steel should be packed for the annealing; no high-speed steel should be pre-heated to more than 1292°F.; no high-speed steel shanks, such as end-mills, reamers, and other tools, where any great amount of strain comes on the shank, should be left soft. They should be hardened at the same heat as the cutting edges. No high-speed steel should be cooled in any kind of a bath that is cooler than 150°F. nor hotter than 1400°F.

No high-speed steel tool should have to be heated after hardening except to anneal.

After hardening no temper can be given high-speed steel in the same sense that a carbon-steel tool is tempered. No high-speed steel should be heated to more than 1292°F. for annealing.

No high-speed steel should be heated for hardening in any fire in which a polished piece of steel could not be melted with the polish still showing as the inside melts and runs out of the piece.

No high-speed steel tool should be taken from the fire until it has reached a uniform heat and becomes nearly transparent.

High-speed steel when properly made and properly hardened will take a permanent set before breaking. In hardening high-speed steel we will notice that it expands ¼ in. to the foot at a temperature of 1825°F. As it cools it gets shorter until about 475°F. and then it begins to get longer and returns to its original measurements, or nearly so.

Annealing high-speed steel is simply and easily done, and, as stated, such steel should not be packed for annealing. The proper method of annealing in the bar is to place the steel in a slow furnace, and, if the pieces have been hardened, they should be cribbed so as to allow free access of the heat. The steel should be slowly heated to 1292°F., after which it should be allowed to cool until it reaches 750°F., or somber red, when it should be reheated to 1292°F., and held at this heat for thirty minutes.

Why is this the best method of annealing high-speed steel? First; it is the least expensive; second, it is quicker; third, it leaves the steel in perfect condition for hardening; fourth, the grain of the steel will be as good as, in fact better than, it is found to be at the first hardening, and tools treated in this manner are as good as new tools.

I do not suppose that it is necessary for me to explain why high-speed steel should be annealed before hardening. The best explanation is to take a short bar and harden and break; then take one piece and harden without annealing, anneal the other and harden, then break both and look at what has taken place in the composition of both pieces.

The hardening of high-speed steel is simple. It requires good judgment and the proper equipment. No man should be allowed to harden high-speed tools until he can harden a bar or a piece of the steel from which the tool is made. I do not believe in the pre-heating of high-speed steel where hardening is being done hour by hour unless it is done to help the high-speed steel furnace, but I do believe in pre-cooling. I find that a high-speed furnace will keep a man going about as fast as he cares to go without any pre-heating, but where a man has a single piece of steel that is not of sufficient volume to reduce the temperature of his furnace to a considerable extent, it is then necessary to pre-heat, but this pre-heating should never be to a higher temperature than 1292°F. I believe in filling the furnace as full as is possible, allowing the operator to get at any piece in the fire that he desires, then bringing all the pieces to the proper hardening heat. There will be sufficient variation in the heat to permit all pieces to be taken from the fire when they have reached the desired heat. The tools or pieces should be quenched in a bath at a temperature of 1300° to 1400°F. and allowed to cool in this bath from three to eight minutes, according to the temper desired, when they should be removed and should finish cooling in oil at a temperature of 150°F. or more.

Now I want to tell why I believe some of the things I have stated. First, the reason the shank of a cutter should be hard is quite simple, it is stronger hardened than annealed. Why should high-speed steel not be pre-heated? I have taken high-speed cutters, many of them, after they have been hardened; in fact, all of the cutters that are annealed in my place are taken and plunged into a lead bath which is at the annealing heat, and we have our first cutter to lose from this treatment. I have practised this method of annealing since 1907, and have annealed tons of high-speed steel. It is quick, and the man with the best, safest, and quickest method will win, no matter who he is. If what I said to you is true, is there any reason for pre-heating the high-speed steel other than to help the high-speed furnace? Why should high-speed steel be cooled in a hot bath? Just this reason: A hot bath is more drastic than a cold bath. Now, do not forget I am talking about a high-speed cooling bath. I have found that by setting four barrels of different kinds of oil side by side, and using them at atmospheric temperature, for cooling a ten-pound tool of the same finish, that in cooling down to 1500°F., which is the point we want to reach as quickly as is possible, there would be as much as double the time required in some oils as in others, whereas if these oils are heated they will come within a few seconds of equal rates of cooling. Why should high-speed steel not be heated after hardening? The work of tempering high-speed steel should take place in the cooling and there is no reason for heating the steel except to anneal.

*Abstract from paper read before the Chicago Chapter of the American Steel Treater's Society.

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Book Reviews

Induction Coils in Theory and Practice. By F. E. Austin. Pp. 61, ill., index. F. E. Austin, Hanover, N. H. For sale by 'Mining and Scientific Press'. Price, $1.

This book is divided into 16 lessons, each of which considers some division of the subject. The explanation of the theory is illustrated by a number of practical examples. The book will be of value to both the student and the electrician.

Chemical Calculation Tables. By Horace L. Wells. Pp. 43. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $1.25.

The principal tables in this book give, respectively, atomic weights, gravimetric factors, atomic weights for the more common chemical formulas, reduction of gas-volumes to 0 and 760 mm., barometric corrections for temperature, multiples for organic compounds, weights and measures, and logarithms. The book will be useful to the chemist and the chemical engineer.

Analysis of Babbitt. By James Brakes. Pp. 169. Allen Book & Printing Co., Troy, New York. For sale by Mining and Scientific Press, San Francisco. Price, $2.

This book describes the various methods for determining the chemical constituents of a given 'babbitt' mixture, and also gives some data on the manufacture of babbitt metal. About half the volume is devoted to a remarkably complete bibliography of the various subjects treated. The book will be useful to persons engaged in the manufacture or testing of babbitt metal.

Iron and Steel. By Hugh P. Tiemann. Pp. 514, ill. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $4.

This is a pocket encyclopedia of the iron and steel industry. The more important terms, such as blast-furnace, heat treatment, and open-hearth process are described fully. The less important ones are either defined briefly, or else cross-referenced to the page of some one of the longer articles where a definition is given. No statement is given of the terms defined but the total must be several thousand.

Steam-Engine Troubles. By H. Hamkens. Pp. 267, ill., index. The Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.50.

This is a practical book for the operating engineer written in non-technical language so that anyone with enough intelligence and experience to run a steam-engine can understand it. Chapters are devoted to the various parts of the steam-engine and the possible troubles that may develop, also to such special subjects as foundations, erecting, valve-setting, and operation. The book is illustrated with nearly 300 small line-drawings. It will be of value to anyone who runs a steam-engine or has one run for him.

Abrasives and Abrasive Wheels. By Fred B. Jacobs. Pp. 321, ill., index. Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $3.

The growing importance of grinding and grinding-wheels alone warrants the publication of an up-to-date book dealing with the subject of abrasives and their uses. The present volume opens with a discussion of natural and artificial abrasives, and then considers the manufacture, testing, and operation of grinding-wheels and grindstones, including a discussion of dust-collecting systems and safeguards. Chapters are also devoted to surface grinding, cylindrical grinding, internal grinding, and special grinding operations, as well as cutter sharpening and saw sharpening. The book is well illustrated.

Directory of the American Association of Engineers. Pp. 190. Ill. American Association of Engineers, Chicago.

The Association is now three years old and has approximately 2200 members, mostly civil engineers, but a number from the other branches. Besides the material usually found in a society year-book there is a directory showing the condensed experience of each member. This is, presumably, mainly with the idea of presenting information in tabulated form to prospective employers. However, unlike most society year-books, addresses are given without information as to the position the member at present holds. This omission is the more remarkable because an employer is frequently more interested in what a man is actually doing than in what he has done.

Iron and Steel. By Erik Oberg and Franklin D. Jones. Pp. 321, ill., index. The Industrial Press, New York. For sale by 'Mining and Scientific Press'. Price, $2.50.

This is a 'popular' book on the iron and steel industry written in non-technical language. The first chapter is devoted to definitions and to notes on the history and to general aspects of the industry. Then follow chapters on iron ore, pig-iron, wrought-iron, steel in general, crucible steel, bessemer steel, open-hearth steel, electric steel, rolling-mill practice, alloy steels, high-speed steel, cast-iron, and steel castings. It will readily be seen that in a book attempting to cover such a large field, the treatment of any particular subject must necessarily be brief, but with these limitations in mind, the book may be said to give an excellent 'bird's-eye view' of the industry.

Astronomy for Surveyors. By R. W. Chapman. P. 241, ill., index. J. B. Lippincott Co., Philadelphia. For sale by 'Mining and Scientific Press', San Francisco. Price, $1.75.

This book is a sort of happy medium between the brief treatment of astronomical theory found in most textbooks on surveying and the highly technical discussion in an astronomical treatise. The first chapter contains a brief review of the principal propositions of spherical trigonometry. Several chapters are then devoted to discussion of theory, which is then applied to the practical problems of determination of the true meridian, of time, of latitude, and of longitude. The book will be of value both to students and to practical surveyors who realize, as most of them should, that their knowledge of the astronomical basis for their work is entirely too limited.

Oxy-Acetylene Welding Manual. By Lorn Campbell. Pp. 148, ill., index. John Wiley & Sons, Inc., New York. For sale by Mining and Scientific Press, San Francisco. Price, $1.25.

This book is intended as a manual for the practical welder, in fact, if anything, it errs too much on the side of the elimination of theory. However, the man that wishes to study the theoretical side of welding can find it discussed in other books. The present volume, after a brief introduction describing the principal uses of oxy-acetylene welding, discusses the apparatus and shop equipment and the general methods of operating the same. Most of the rest of the book is devoted to the special problems in connection with the various metals most commonly welded, including cast-iron, malleable iron, steel, brass, and aluminum. Another chapter considers the use of the oxy-acetylene torch in cutting metals, and there is also a chapter on the oxygen process for burning carbon from cylinders of internal combustion

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engines. The book appears to have been hastily written, and there are many sentences that could have been made less obscure by a little careful editing. However, it will be useful both to the practical welder and to the man learning the trade.

Handbook of Mechanical and Electrical Cost Data. By Halbert P. Gillette and Richard T. Dana. Pp. 1716, ill., index. McGraw-Hill Book Co., New York, 1919. For sale by 'Mining and Scientific Press'. Price, $6.

As the preface states, this book is intended as a companion volume to Mr. Gillette's 'Handbook of Cost Data', and Mr. Dana's 'Handbook of Construction Plant'. The arrangement is similar to the former book, but there is little overlapping. In these days of abnormal prices, and of discussion as to whether or not large reductions will be made in the near future, some engineers and estimators may feel that a book of cost data, since its costs manifestly cannot be brought up to the minute, is of slight value. That this viewpoint is erroneous, provided the cost analysis is accurate and complete is shown by the authors in the first chapter.

Broaches and Broaching. By Ethan Viall. Pp. 216, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $2.

The author defines broaching as "the working out of holes or slots, or the machining of surfaces, by tools having a number of successive cutting teeth of increasing size, no matter whether these teeth are arranged singly or in multiple." The book discusses the special field and advantages of broaching work. The chapter-headings are: Broaching and Broaching Tools; Standard Types of Broaching Machines; Examples of Pull-Broaching Work and Practice; Examples of Push-Broaching Work and Practice; The Design of Pull-Broaches; The Design of Push-Broaches; Making Broaches. The book is well-illustrated with photographs of machines and of work done on them. It will be of value to machinists generally.

The American Machinist Shop Note Book. Compiled by E. A. Suverkrop. P. 293. Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press', San Francisco. Price, $2.

This is a collection of several hundred 'shop-kinks' that have appeared in 'The American Machinist'. These kinks are classified according to the department of shop work to which they belong, under Drafting and Design; Patterns and Foundry, Forge Shop, Hardening, and Tempering; Drilling Machine, Engine-Lathe; Milling Machine; Planer and Shaper; Tool Making; Die and Press Work; Gauges; Grinding; Boring; Gearing; Screw-Machine; and Shop Tools, Appliances, and Expedients. As the compiler points out, a book of this kind has a two-fold value, first, in showing how a certain specific job was done, and second, and more important, in suggesting lines of thought that may lead to the discovery of improved methods of doing other jobs.

Punches and Dies. By Frank A. Stanley. Pp. 425, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $4.

This is probably the most complete and up-to-date book on the subject that has appeared. The author has had much practical experience along these lines, and, at the same time, writes about his subject clearly. The first chapter is devoted to a general discussion of press-tools, and then dies of various kinds are taken up in detail, including dies for blanking, piercing, cutting-off, shaving, trimming, drawing, bending, forming, embossing, marking, riveting, swaging, and indexing, as well as combinations of two or more of these operations. The last few chapters are devoted to design, layout, construction, and heat treatment of dies. The book is well illustrated with both photographs and line-drawings. It will be of value to machinists, shop superintendents and foremen, and, in fact, to anyone interested in punch-and-die work.

Applied Mechanics. By Charles E. Fuller and William A. Johnston. Volume II—Strength of Materials. Pp. 538, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.75.

This is a text-book prepared by two members of the faculty of the Massachusetts Institute of Technology. It is a good text-book, and makes no claim to be anything else. The mathematical discussion of the various principles involved is complete, and it is illustrated at the end of nearly every chapter by a number of problems. The student may, however, be disappointed to find that few of them are worked out for him, neither are there any 'answers' in the back of the book. The scope may be judged from the chapter headings, which are Physical Properties of Materials, Analysis of Stress and Strain, Uniform Stress and Uniformly Varying Stress, Stresses in Beams, Deflection of Beams, Continuous Beams, Combined Stresses, General Theory of Flexure, Columns, Shafting and Springs, Curved Bars, and Reinforced Concrete Beams and Columns.

Walls, Bins, and Grain Elevators. By Milo S. Ketchum. Third edition. Pp. 546, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $4.

It is seven years since the second edition of Professor Ketchum's standard treatise appeared. The principal new material to be found in this edition includes data on the economic design of reinforced concrete retaining-walls, formulas for wedge-shaped reinforced concrete beams, formulas for calculating the load on bin-walls, the calculation of pressures in sand-boxes, problems fully worked out in the design of retaining-walls and bins, and the report on the design of retaining-walls adopted by the American Railway Engineering Association. In addition, there have been a number of minor changes. The book considers the design and construction of walls, bins, and elevators constructed of various materials, together with cost data and descriptions of actual structures. Like the previous editions, the treatise will prove a necessity for anyone engaged in that class of work.

Engineering Descriptive Geometry and Drawing. By Frank W. Bartlett and Theodore W. Johnson. Pp. 577, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.50.

The senior author is a captain in the U. S. Navy and was formerly a professor at the Annapolis Naval Academy; the junior author is now a professor at the Academy. The book is primarily a textbook for use at the Academy, in fact, it would be difficult to use it as a textbook at any other technical school unless the courses of instruction had been modeled directly on those at Annapolis. The treatment of the various subjects has the thoroughness that we are accustomed to associate with military and naval matters. The book is divided into three parts, which are virtually independent of each other. Part I on Line-Drawing discusses thoroughly the various instruments and other equipment required in the drafting-room, together with their use. The remainder of this division of the book is devoted to ordinary lettering and line-drawing, as these subjects are taught at Annapolis. Part II, on Engineering Descriptive Geometry, discusses in an equally thorough manner the descriptive geometry of lines and plane and

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curved surfaces, together with isometric sketching. Part III on Engineering Drawing proceeds from the discussion of simple sketches of small machine parts to the more difficult branches of mechanical drawing, including ship lines and plate and structural-steel work. There is an appendix giving lists of standard pipe-fittings, bolts, screws, and structural material.

Office Management. By Lee Galloway. Pp. 670, ill., index. The Ronald Press Co., New York. For sale by 'Mining and Scientific Press'. Price, $6.

The domain of the 'office' was for some considered as a sanctuary from the efficiency expert, but such is no longer the case. The office-manager must meet the cold clear eye of Missourians just as the manager of any other department. The present volume is one of the most complete that has appeared on the general subject indicated by the title. It discusses every branch of the office, including the clerical, stenographic, filing, purchasing, sales, advertising, and accounting departments. Selection of an office-building, office equipment, methods of organization, training of workers, wage and bonus systems, as well as many other minor subjects are also discussed. While much of the discussion is better adapted to the needs of the office employing several hundred clerks than to the small establishment, the office-manager or the owner of a small business will find a great deal that will be of interest and value to him.

Liquid Fuels for Internal-Combustion Engines. By Harold Moore. Pp. 191, ill., index. D. Van Nostrand Co., New York. For sale by 'Mining and Scientific Press'. Price, $5.

This book is divided into three parts. Part I discusses the various liquid fuels, including petroleum, shale-oil, and the various tar-oils, as well as the less important alcohols, animal and vegetable oils, and the products of the distillation of wood and peat. Part II classifies these oils according to their suitability for engines with carbureters and for Diesel and semi-Diesel engines with atomizers or vaporizers. Part III discusses the examination and testing of fuel-oils. An appendix contains a brief glossary, several sets of specifications, and some statistical and mathematical tables. The book is written from the viewpoint of the British user of fuel-oil, which interferes somewhat with its usefulness to the American reader. However, the American engineer whose interest in the subject is sufficient to counterbalance the relatively high price asked for the book will find it of value.

Mathematics for Engineers. Part I. By W. N. Rose. Pp. 474, ill., index. E. P. Dutton & Co., New York. For sale by 'Mining and Scientific Press'. Price, $5.

This volume, which is Part I, is devoted to elementary and higher algebra, mensuration and graphs, and plane trigonometry. Part II will consider calculus, harmonic and vector analysis, spherical trigonometry, and kindred subjects. The book is designed rather as a reference book for the practicing engineer, whether he be college-trained or self-educated, than as a text-book for the student, although it would also be of considerable value in supplementing the ordinary textbook. While mathematical theory is expounded carefully, the practical application of that theory is kept ever to the front with problems to be solved that are really practical, not like the old-style 'clock' problems that many of us remember. The chapter-headings are: Aids to Calculation, Equations, Mensuration, Graphs, Algebra, Plane Trigonometry, Areas of Irregular Curved Figures, Calculation of Earthwork Volumes, Platting of Difficult Equations, Determination of Laws, and The Construction of Charts. The text, unfortunately, contains a number of typographical errors, which should be corrected in another edition. However, these are relatively unimportant, and the book in general will be useful both to the practicing engineer and the student.

Waterproofing Engineering. By Joseph Ross. Pp. 427, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.

As the author points out, the literature on waterproofing processes and practice is remarkable principally because there is so little of it. Not only has little investigation of the subject been done, but many of these who have made such studies have, for commercial reasons, kept the results of their work secret. The chapter-headings are as follows: Need and Function of Waterproofing; Systems of Waterproofing; Impervious Roofing; Waterproofing Expansion-Joints in Masonry; Waterproofing-Materials; Waterproofing Implements and Machinery; Technical and Practical Tests; Specifications; Recipes and Special Formulas; Application; Cost Data. Another chapter contains a number of tables of special use in this class of work. There are appendixes containing a discussion of mechanical analysis of concrete aggregates, concrete in sea-water, the American Society for Testing Materials report on waterproofing, a glossary, and a list of references. The book will be useful to anyone engaged in the erection of buildings or other structures that have to be waterproof, or at least moisture-resistive.

The Construction of Graphical Charts. By John B. Peddle. Pp. 155, Ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $2.

The author is professor of machine design at Rose Polytechnic Institute, and the book, although on a sound theoretical basis, is written from the standpoint of the engineer rather than the mathematician. The first five chapters discuss the various kinds of charts in two dimensions, comprising those platted for rectangular co-ordinates, including logarithmic charts, alinement charts for three or more variables, hexagonal charts, and proportional charts. The next chapter is devoted to the derivation of empirical equations from points already platted on any kind of a chart. Following this is a discussion of stereographic charts and solid models, and the final chapter considers determinants and their use in the derivations of equations and formulas. The treatment of the various subjects is as simple as possible, and can be readily followed by anyone having a knowledge of elementary algebra. It will be useful both to the engineer and as a textbook for the student.

Metallic Alloys. By G. H. Gulliver. Pp. 396, ill., index. Charles Griffin & Co., Ltd., London. For sale by 'Mining and Scientific Press'. Price, $3.75.

The author in his preface expressly disclaims any intention of writing a book suitable as a guide in the practical manufacture of alloys, yet it is none the less true that a knowledge of equilibrium conditions and of conditions governing the stable or unstable condition of mixtures such as can be obtained from this treatise would be of value to the foundryman, both in preparing his charges and in the further heat treatment. Chapter I is on methods of investigation, with particular reference to the microscope. Chapter II discusses the physical and chemical equilibrium of mixed substances. Most of the rest of the book is devoted to the various classes of alloys, both of two metals and of more than two metals. Separate chapters are devoted to the brasses and bronzes and to steel and other alloys of iron. Considerable space is also given to the structure of metals and alloys. There are more than 300 illustrations, about

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equally divided between microscopic sections and equilibrium diagrams. Besides its usefulness as a textbook, the treatise should be of value to the practical worker in metals who wishes to increase his knowledge of the 'why' of his calling.

Irrigation Engineering. By Arthur P. Davis and Herbert M. Wilson. Pp. 617, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $4.50.

Wilson's 'Irrigation Engineering' has been a standard treatise and book of reference for over 20 years. In this seventh edition, the co-operation of Mr. Davis has been enlisted, and the result has been a complete revision, with the addition of much new matter. The principal changes include a fuller treatment of subjects connected with the operation and management of irrigation systems, such as soils, plant-food, preparation of land for irrigation, duty of water, applying water to land, and maintenance of canals. The principal chapter-headings are Soils, Soil-Moisture, Plant-Food, Water Supply, Evaporation, Pumping for Irrigation, Irrigable Lands, Application of Water to the Land, Duty of Water, Measurement of Water, Drainage, Canals and Laterals, Canal Structures, Storage Reservoirs, Sedimentation of Reservoirs, Dams, Water Rights, Operation and Maintenance, Investigation of a Project, and Specifications.

Metal Worker's Handy Book of Receipts and Processes. By William T. Brannt. Pp. 550. Ill., index. Henry Carey Baird & Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

The wide scope of this remarkable collection of data can best be judged from the chapter-headings, which are as follows: Chemical Relations of the Metals; Metallic Preparations and Chemicals Used in the Metal Industry; Determination of the Constituents of Metallic Alloys; Alloys and Amalgams; Annealing, Hardening, and Tempering; Bronzing and Coloring; Casting and Founding; Cements; Cleansing, Grinding, Pickling, and Polishing; Decorating, Enameling, Etching, and Engraving; Electro-Plating; Brassing; Coppering; Galvanizing, Gilding, Etc.; Fluxes and Lutes; Lacquers, Paints, and Varnishes; Soldering and Solders; Welding and Welding Compounds; Wire; Flame Welding and Cutting; Thermit Welding; Electric Welding; Galvanizing and Sherardizing; Die Castings. The chapter on Alloys and Amalgams, for instance, contains receipts for more than one hundred distinct alloys, and the chapters discussing processes are equally exhaustive. As is important in a book of this kind, the index is ample, comprising more than thirty pages, and is well arranged. With such a wide field and such a comparatively small book, discussion of theory is wisely omitted as well as any other matter of text-book rather than reference-book character. Furthermore, there is no one with such wide interests as to find all of the book of direct value to him. Nevertheless, the book will be worth while to almost anyone engaged in practical work in one or more of the fields of activity indicated by the chapter-headings.

Excavation; Machinery, Methods, and Costs. By A. B. McDaniel. Pp. 526, ill. The McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.

If it were not for excavating machinery, the 220,000,000 cu. yd. of material at the Panama Canal could not have been moved, nor could 35,000 tons of ore per day be moved from the Utah Copper Co. From the coolie shoveling earth into small baskets to the steam-shovel operator handling 6000 cu. yd. per day is a long step. The present volume is a revision and enlargement of the author's earlier volume on 'Excavating Machinery'. The same general arrangement is followed in the first part of the new book, each kind of apparatus being discussed in turn, but, whereas in the earlier volume the description of each class of equipment was followed by examples of its practical application, together with cost data, all this information, along with a good deal more of the same kind has been placed in Division II in the present volume. The chapter headings in Division I are as follows: Tools for Loosening and Hand Excavation; Drag and Wheel Scrapers; Blade or Road Graders; Elevating Graders; Capstan-Plows; Power-Shovels; Scraper, Templet, Trench, and Wheel Excavators; Cableways; Dipper-Dredges; Ladder-Dredges; Hydraulic Dredges; Subaqueous Rock-Drills; Car and Wagon Loaders. Division II, as already noted, is devoted to the practical application of excavating equipment including cost data. The arrangement here is according to the kind of work rather than the machine used for doing it, the chapter headings being: Highway Construction; Railroad Construction; Reclamation Work (including both irrigation and drainage); Rivers, Harbors, and Canals; Municipal Improvements; Quarries, Open-Cut Mines, Gravel-Pits, Brick-Yards; Tunnels and Underground Mines. A curious omission is that no mention is made of gold-dredges, although a large part of both divisions is devoted to dredges. The book is well-illustrated, mainly from manufacturer's catalogues.

Industrial Goodwill. By John R. Commons. Pp. 198, index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $2.

Perhaps the most interesting thing about this book is the frank recognition by the author, himself an outsider, that an outsider cannot know as much about a given industrial dispute as the parties directly concerned. The fundamental idea of the book might be said to be that goodwill between employer and employee must be the foundation for any satisfactory industrial arrangement. The first chapter takes up the old idea that labor is a commodity to be treated like other commodities. Naturally, it does not take long to dispose of that theory. Next comes a discussion of the viewpoint that looks upon a workingman as a machine. While the good work accomplished by the efficiency engineers is recognized, their lack of appreciation of the human element is shown. The interest of the public in industrial relations is then discussed, this interest being the reason for legislation affecting certain industrial relations. However, the author, while in general favoring such measures as compulsory workmen's compensation and health insurance, makes it clear that the general provisions of industrial legislation should preferably be agreed upon by the men directly concerned in the industry before being presented to the legislative body. In another chapter a strong plea is made for vocational education by the State. The author suggests a novel solution for the unemployment problem in the form of a basic day of eight or even less hours per day, thus providing work for practically everybody even during periods of depressions with the further advantage that the allowance for overtime would be the most satisfactory form for sharing the profits of prosperity. These are merely some of the 'high points' of a remarkable book. The last chapter is devoted to a brief review of industrial and social conditions since Karl Marx issued his Manifesto in 1848, showing how Marx and his followers guessed wrong and how industrial goodwill can be attained not through socialism but through the use of more rational methods. Reading and even study of this book will well repay both the employer and the labor leader. They will disagree with many of the conclusions expressed, but they will find considerable food for thought.

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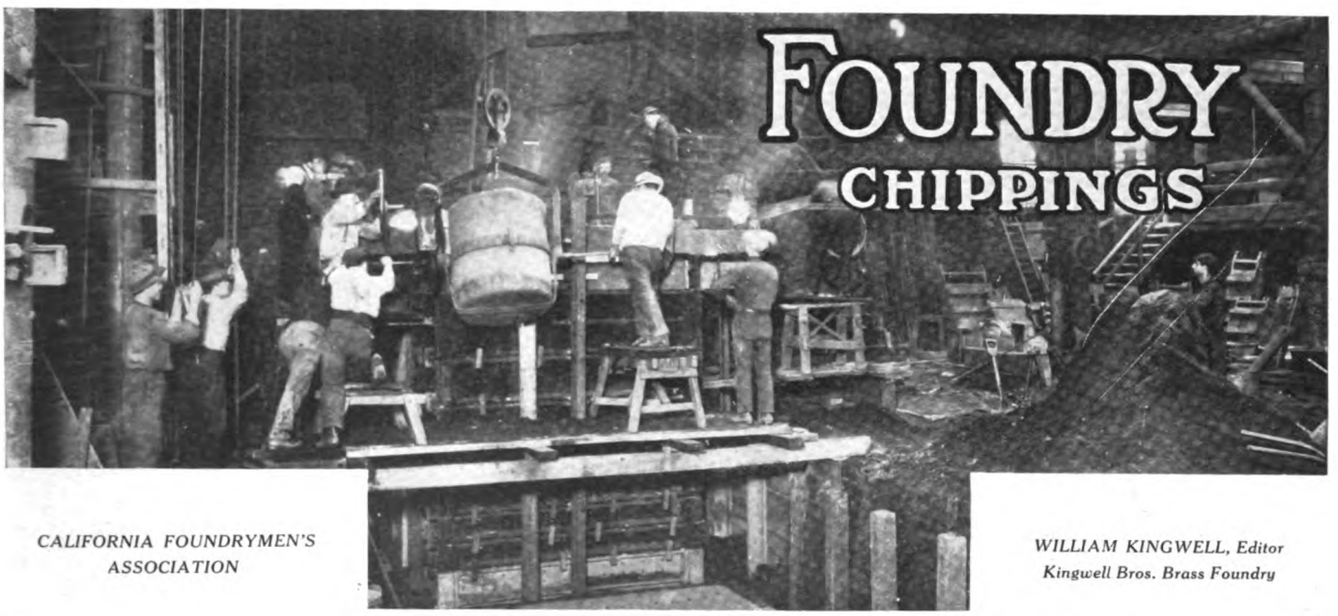

Pyrometers and Core-Ovens

By G. W. KELLER*

Pyrometers have been used in malleable-iron and steel-annealing plants for a number of years, but it is only comparatively recently that the importance of knowledge and control of the temperature of core-ovens has been appreciated sufficiently to make the use of pyrometers common in this field also. The operation of the earlier pyrometers was based on the difference of expansion of a graphite rod enclosed within a steel stem. The great disadvantage with this type is that the indicator must be directly connected with the steel stem, which makes it necessary to place the indicator inconveniently close to the furnace.

The electric-thermocouple pyrometer, which is the most common type, permits the indicator being placed at any convenient point. The thermocouples are composed of two wires of slightly different alloys, welded at one end. They are provided with an outer protecting sheath, which practically eliminates direct oxidation or burning away of the elements of the thermocouple at moderate temperatures.

Pyrometers relieve the oven-tender from worry regarding temperatures. They also furnish the superintendent with valuable data regarding the best temperature for certain sizes of cores. It is natural that a large core should take more time than a small light core. The maximum temperature should not be exceeded, but the average length of drying must be studied. At many plants the ovens are filled frequently with all sizes and dimensions of cores. Naturally if the oven is unloaded at the proper time for the light cores the heavier ones will still be green. Cores should preferably be classified as to size before drying, but where this cannot be done the time of heating should be the average of the proper times for the whole lot. By the use of a switchboard with contacts, any number of core-ovens can be connected to a central-station pyrometer, as shown in Fig. 1.

The electric pyrometer can also be used with a recording dial to give a complete record of temperatures at the core-oven. For this type of service a recording long-distance thermometer of the gas-filled type is frequently used. The operation of the gas-filled thermometer is based on the principle of a nitrogen gas-filled bulb under

FIG. 1. PYROMETER WITH SWITCHBOARD FOR SEVERAL CORE-OVENS

pressure. This gas expands when the bulb is heated, and the pressure thus exerted is carried to the recording instrument, which may be placed at any point within about 100 ft. of the bulb. Care should be taken that connecting tubing is not placed where it can be damaged.

By using an automatic-control pyrometer, the tem-

*Brown Instrument Co., Philadelphia.

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perature in the core-ovens can be regulated whether the oven is heated by gas or by electricity. The control-mechanism is actuated by solenoid-operated valves, which regulate the supply of gas or electricity.

RECORDING LONG-DISTANCE THERMOMETER OF THE GAS-FILLED TYPE

To sum up, the use of pyrometers with core-ovens eliminates guesswork as to the temperature inside the ovens, furnishes a practical guide to the oven-tender by

CONSTRUCTION OF THERMOCOUPLE

which to gauge the time of core-drying, lowers fuel consumption through maintenance of correct temperatures, and furnishes a check on the operation of the ovens.

MR. AND MRS. OLDWED had so many children they didn't know what to do, so they took the whole pack off to a picnic on the river, and let them run riot.

Suddenly a small boy ran up to Mr. Oldwed and cried out:

"Papa, papa! Archibald has fallen into the water!"

"Archibald, Archibald!" repeated the father. Then he turned to his wife. "Alice," he inquired, anxiously, "have we an Archibald?"

Chinese Foundries*

Chinese foundrymen early developed skill in many branches of the art. Bronze statues and bells that showed ability both in ornamentation and in the handling of large castings were produced in the years when civilization in Europe was at low ebb. The famous astronomical instruments of bronze stolen by the Germans at the time of the Boxer uprising of 1900 furnish another instance of the skill of the early Chinese, not only as founders, but also as astronomers and artists. In the province of Shansi there is an old temple at which there are four cast-iron statues, human figures of more than life-size. One of these, the best in point of workmanship, is shown by the inscription to have been cast during the Sung dynasty (A.D. 960 to 1127).

The present-day foundries produce good work, although the methods used are frequently primitive. This is partly because labor-saving devices are of relatively small advantage when labor is as cheap as it is in China. Even in Tientsin, while foreign influence is shown in the fact that such articles as cams, gears, pipe, fittings, and building columns are produced, the methods are far from advanced. Wood is scarce in most parts of China, and a stock of iron flasks is also beyond the means of the average foundryman. Great economy in the use of flasks is therefore practised. Wherever possible, the molds are made with the ground as the nowel and a flask used for the cope only. Snap-flasks have not come into use except in a few foundries where a continuous similar product is turned out under foreign supervision, as in a few railroad shops.

While some of the foundries use a modern type of blast mechanism most of them have various hand-operated contrivances, of which perhaps the most common is the 'wind-box'. This consists of a rectangular wooden box in which slides a closely-fitting wooden piston, operated by a rod coming out of one end of the box. In the lower inside corners of the box are square longitudinal boxes for air-passages, which have clapper-valves at each end so that the piston gives a blast on both strokes. The blast comes out of the side at the middle of the box. The piston is cut at the corners to fit over the air-passages. Bellows of this design and of various sizes are used all over China for forges and smelters as well as for cupolas. The piston is packed with feathers to get as near an air-tight joint as possible.

Except where foreign influence is strong, the cupolas in Chinese foundries are of one type. They are seldom more than a few feet high, and are in two parts. The upper part is a cylindrical cast-iron case lined with fire-clay, slightly flaring at the top, and with a hole in the side for the tuyere-pipe connection. This tuyere-hole points diagonally down on the inside of the cupola. The

*Abstract from article in 'American Machinist', by F. A. Foster.

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lower part is a saucer-shaped receptacle lined with fire-clay and fitted with trunnions for tipping the cupola when pouring. The top is luted to the lower part. In the bottom part there is a socket into which a wooden handle can be inserted for tipping the cupola.

The ladles are clumsy and heavy, and are not as deep as those used in American foundries. In most foundries the size of the work seldom requires a two-man ladle.

One notable product of Chinese foundries is the very thin ware that is frequently made, particularly for cooking-pans. Because of the high price of fuel and the smallness of the stoves used, these pans must be as thin as possible. The molds are made of what appears to be a good quality of molding-loam mixed with clay and powdered pottery, which makes a strong heat-resisting material after it has been baked by burning wood over it. Numerous vent-holes are made in the material to let out the gases. These molds are used over and over again. The surface of the molds is smooth, producing clean work.

One kind of foundry that is not often seen anywhere else is a traveling concern. The proprietors of these itinerant furnaces go from place to place in the farming regions, collecting old iron and re-melting it into plow-points and other implements needed by the farmers. Here is where the permanent molds already mentioned are of great advantage.

SVEN had been nursing logs down the chute to the buzz-saw for several hours when the boss came along.

"This bane too much work for one man," Sven told him.

"All right," said the boss, "I'll send John down to help you."

An hour passed and the boss came past again. Sven made the same complaint:

"This bane too much work for one man."

"But I sent John down to help you. Where is he?"

"Yohn, he ain't bane here some time. He vent down between two logs. I tank he quit his job."—Los Angeles 'Times'.

A COLORED BOY was taken in the draft last fall and sent to Camp Grant. After a few weeks, he came very homesick, and one dark night decided to visit his home without leave. All went well until he neared the outskirts of the camp, when the sentry accosted him thus:

"Halt there, where you goin'?"

"Ahm going to Chicago."

"Have you got a pass?"

"No, Sah, I haven't."

"You can't leave this camp without a pass."

"Look a heah, boy; I'se got a mother above, and father down below; and a sweetheart in Chicago; an' I know I'se going to see one of them three before this night is over."—The Yellow Strand.

The Machinery Trade of Java

By W. H. RASTALL*

The American consul in one of the less prominent cities of Asia recently found over twelve hundred trade inquiries in one mail. During recent months other mails have been much the same. Obviously, American manufacturers are becoming interested in developing their business in Asia.

A most interesting situation is disclosed by the following data taken from the customs returns of the Netherlands East Indies government. Although these figures include the machinery imported into the whole archipelago, by far the greater part of this equipment went to Java.

The table below gives the value of the total machinery imports into Java and the share of this trade held by three principal exporting countries from 1900 to 1917, inclusive:

Year	Great Britain	Germany	United States	Total
1900	$901,686	$70,350	$20,100	$4,544,610
1901	597,774	77,184	75,174	3,947,238
1902	309,138	147,534	29,346	2,916,510
1903	332,454	131,856	19,296	2,209,794
1904	387,528	147,131	38,592	3,038,316
1905	614,658	197,784	49,848	4,605,714
1906	509,334	438,582	45,828	4,551,846
1907	707,922	561,996	50,250	4,965,505
1908	1,033,542	526,620	46,632	6,825,960
1909	648,828	476,772	36,984	5,035,854
1910	817,668	736,062	85,224	6,282,054
1911	1,290,822	1,053,642	106,128	8,055,678
1912	2,191,704	1,511,520	122,610	10,617,624
1913	1,835,532	2,208,990	204,618	13,218,966
1914	1,973,418	1,349,916	295,068	10,103,466
1915	1,159,368	223,914	379,890	6,463,758
1916	1,568,604	26,934	1,165,800	8,015,880
1917	1,518,756	7,236	2,474,312	8,431,548

It would be interesting to know the changes the next few years will work in the distribution of this business. The Netherlands East Indies was a neutral territory during the War and the German name still carries a certain goodwill in engineering circles. As soon as military conditions permit, the Germans will start their efforts to recover this business. The German firms in Java have not only kept their doors open and their organization complete throughout the War, but they have been able to show a profit on the business done. British manufacturers are also well organized and will be active.

The position now held by American manufacturers can be maintained if those interested will make a reasonable effort. As yet America has done little work in the Java market, but Germany's record, as given in the above table, shows what can be accomplished by good and persistent salesmanship. Active effort, with American methods, will show even better results, especially if started at once. American banks have opened branches in Java; American steamers now run direct and regularly. Conditions are right, and it seems probable that trade energy can be expended more profitably in the Netherlands East Indies than in many of the other markets of the world.

*U. S. Trade Commissioner.

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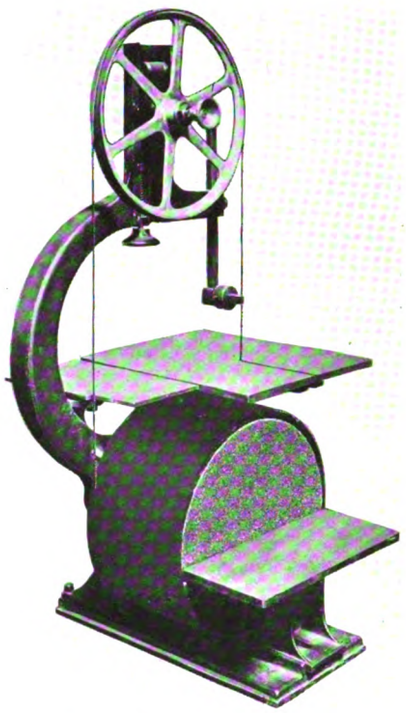
INDUSTRIAL EQUIPMENT

COMBINATION BAND-SAW AND SANDER

F. Haase, 252 Fremont street, San Francisco, has designed and is now ready to market, a combination portable band-saw and sander for the pattern shops. The machine, as shown in the illustration, is designed to be placed on the pattern-maker's bench to avoid time lost in walking to the



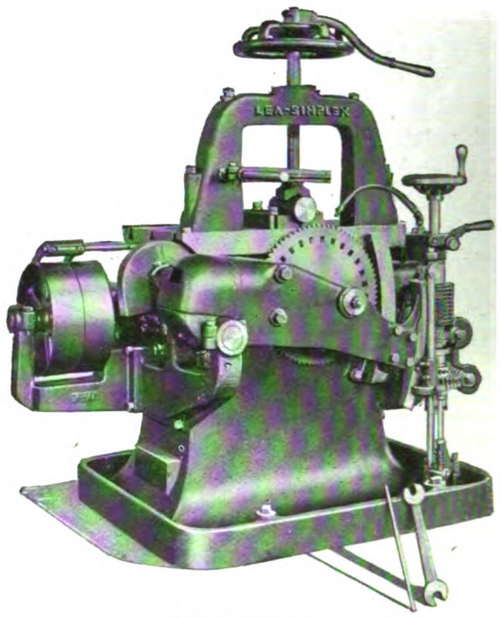
The Haase Band-Saw and Sander

larger machines. The height of this tool is 2 ft. 10 in. overall, and the sander is 12 in. diam. It is equipped with a ¼-hp. Westinghouse motor, which can be run from an ordinary electric-light socket. The lower pulley and sander-wheel is built in the form of an exhaust-fan, which collects 90% of the dust. Both the saw and sander-table can be tilted as much as 45°. The experience of a pattern-maker that has used one of the first machines is that this combination bench-machine will do 80% of the work that comes to his shop and at a large saving in pattern-maker's time. The machine sells for considerably less than either a sander or a band-saw.

LEA-SIMPLEX COLD-METAL SAWS

The swing-arm type of cold-metal saw has several distinct advantages. When the blade is returned to starting position, which is done by an automatic stop and rapid-power return, all moving parts are below the saw-table, leaving the table-top clear for setting up the work either with the standard clamping-yokes furnished with the machine or with special clamps, either device being held in place by the tee-slots in the table-top. The blade, being fed upward into the stock and not pushed sideways into it, always meet the stock squarely and even when angle-cuts are made does not touch the work at an angle. Therefore, there is no tendency to crowd the blade away or to distort it. The use of the sprocket-drive with the small arbor, which is only a guide and transmits no power, means larger cutting capacity with a given diameter of blade than with an arbor-driven saw. With the sprocket-drive, the blade is pulled through the work and, not being under compression, as in the case with an arbor-driven saw, has no tendency to buckle. This feature, together with the use of friction-washers on the feed-worm, which slip when the feed is too great, reduces blade breakage to a minimum. For a given cutting capacity, a saw of this type is more compact than any other. All the controls are centralized and can be reached from one point.

The Lea-Simplex cold-metal saws have the following exclusive features: Three-point suspension of the swing-arm, which is not overhung as is the case with other saws of the



Lea Simplex Saw

swing-arm type. Durability and rigidity are ensured by the use of an outer trunnion, thus providing three-point suspension. Quick-change geared feed, which provides five rates of feed. The gear-box is similar to an automobile transmission, and the gears can be shifted without stopping the machine. An automatic stop and quick power-return, which makes it possible for one operator to handle several machines with a minimum loss of time. Power applied through spur and bevel-gears only. Therefore, the friction loss is slight and there is no need of thrust-bearings in the drive. This reduces power requirements to a minimum and results in the highest efficiency. Swing-arm fed upward by a worm and quadrant, which gives a steady uniform feed throughout the entire movement of the arm.

The Lea-Simplex saw is manufactured by the Earle Gear & Machine Co. Harron, Rickard & McCone are the Pacific Coast agents.

GRAB-BUCKET FOR FOUNDRY WORK

A machine that is being found almost indispensable in many foundries is the P. & H. single-line grab-bucket. Rugged simplicity is the chief feature of this bucket. No special crane-equipment or hoisting-apparatus is needed. It is simply slipped on the crane-hooks and is as easily detached as a ladle when the crane is needed for other service. At one foundry, a 60-ton car of sand is unloaded in one hour by the crane-operator and one laborer using the grab-bucket. A sand heap 80 ft. long, 4 ft. high, and 5 ft. wide, can be thoroughly cut and mixed for the molder in 35 minutes by the crane-operator and a laborer. Another foundry uses the bucket for digging pits, tempering sand, and loading

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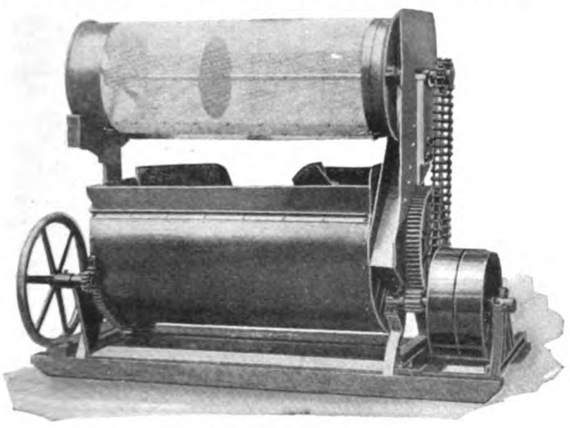
refuse material, such as slag from the open-hearth department. Although this foundry uses the bucket on an average of only one to two hours per day, it is able to dispense with the services of five men. The Pawling & Harnischfeger Co.

P. & H. Grab-Bucket

has recently established offices at 1104 Central Bdg., Los Angeles, and at 821 Monadnock Bdg., San Francisco. These, in addition to the office in the Pittock Block, Portland, make a strong chain of P. & H. service on the Pacific Coast.

THE BLYSTONE SAND-MIXER

Hand mixing in the foundry is open to a number of objections. It is expensive, it is not thorough, and it is laborious and therefore distasteful to the workman. The Blystone mixer, manufactured by the Blystone Manufacturing



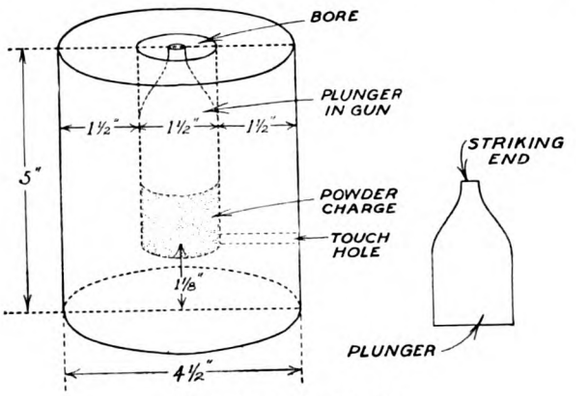
The Blystone Mixer

Co., of Cambridge Springs, Pensylvania, and handled by Ditty Bros., of San Francisco, was developed about nine years ago. The mixing-shovels are set in a sort of reverse spiral, three shovels working in opposition to the other three. At the same time the longitudinal movement throws the sand from one end of the drum to the other. The mixer is made in two sizes. The No. 1 size has a capacity of 7 to 9 cu. ft. and requires a 3-hp. motor. The No. 2 size has a capacity of 5 to 6 cu. ft. and requires a 2½-hp. motor. It has four shovels instead of six. The illustration shows the No. 1 size equipped with a screen.

GUNPOWDER SAVES MECHANICS' TIME

Gunpowder is employed in an unusual way in the machine-shops of the Delaware & Hudson Railroad Co. at Watervliet, New York. Ordinary black sporting powder is used for the following purposes:

Blowing nuts and bolts (sweated on), of which there are many required in the construction of locomotives and



'Gun' for Use in Machine-Shops

other railroad equipment. Breaking up iron and steel to be scraped. Forcing a locomotive-piston when rust or corrosion binds it. Breaking metal that has become cold in a furnace. This has been done without the slightest injury to the lining.

The charge of powder is loaded in steel guns of various sizes and is held by a steel plunger, which is forced out when the charge is exploded. No wad is used. The plunger is milled to fit the bore of the gun easily. The accompanying sketch shows the gun and plunger. These guns range from 5 to 12 in., end to end, with other dimensions in proportion. Some of the gun-barrels are milled in the shape of an octagonal prism, instead of being cylindrical, the bore in all cases being round.

The gun, after having been loaded, is jacked-up with the mouth about one inch from the object to be struck by the plunger, and then fired. About 1 oz. of powder is used per nut or bolt of the sizes in common use on locomotive construction. The charge is varied with the work to be done. By the use of these guns much time and labor has been saved; also a sharp, quick blow can be directed at an object that can hardly be reached in any other way.

RIVET-HEATING FORGE

The invention of a new type of rivet-forge by one of the employees of the Pacific Coast Shilbuilding Co. is described in 'Full Speed Ahead', the plant house-organ, as follows:

"An improved oil-forge for heating rivets has been devised by J. T. Shepherd, plant-plumber. Several of the forges are already at work. One of their most commendable features is the avoidance of back-fire. Higher vaporization of the oil is secured through the use of the new invention. The main features are a valve on the air-line and a needle-valve on the oil-supply, with a mixing-chamber. The latter is formed of a 1¼-in. tee with a 1¼-in. nipple and a bell-reducer reducing to ¾ in. Above this is a second mixing-chamber, formed of a 1-in. ell, the oil being carried thence through a 1½-in. tee with a ¾-in. nipple, forming an injector. Free air is taken in with the vapor. There is a ¼-in. vent on the tank, to make filling quicker, the vent forming a suction on the funnel. It is not necessary for the boy to go to the manifold to turn the air off. This is done at the furnace. Another advantage is that the new forge needs no leader to connect the hose. A male hose-connection is used, obviating two couplings. The piping on the end where the

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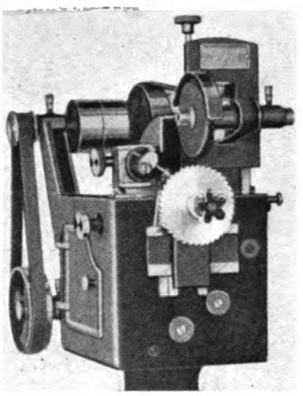
valves are controlled is protected with a stay-plate, reducing the danger of damage to the forge. The danger of back-fire is eliminated by fire-clay sealing. The forges are also equipped with bleed-valves, making it possible to clean the tanks easily. Not only can water be bled from the oil, but the bottom of the tank can be blown clean."

SAW-SHARPENER

The No. 10 automatic milling or slitting saw-sharpener manufactured by the Machinery Company of America, Big Rapids, Michigan, was designed for re-grinding and re-cut-



Saw-Sharpener

ting slitting or milling saws 2 to 10 in. diam., with the usual spacing, and is especially adapted to the reclaiming of thin slitting saws with fine tooth-spacings, which in the past have been discarded because there has been no efficient means of re-sharpeening. With this grinder they may be re-sharpened repeatedly until the entire value is received from the blade. The grinding of the teeth is absolutely uniform; th cutting points are kept perfectly 'in spacing', equalizing the strain on the saw, and keeping them always sharp and in perfect condition, ensuring smooth fast cutting with reduced friction and heating of the blade in the cut. The action is fully automatic, requiring little attention on the part of the operator after being placed in operation. An automatic attachment can be furnished for automatically taking up the wear of the grinding-wheel by feeding the work up to the grinding-wheel as the grinding-wheel wears. With this attachment, and without attention from the operator, the machine will take a blank disk of steel and automatically make from it a perfectly spaced slitting or milling saw, with teeth of such size and shape as may be preferred, with perfect cutting points, and with accurate spacing.

CINDER-MILLS

The iron and coke recovered in a foundry with a cinder-mill in a few months will more than pay for its cost. This can be demonstrated by weighing the iron and coke in the cinder and gangway scrapings, and assuming that 95% of the iron and 75% of the coke can be saved. Cinder usually carries from 35 to 50% good iron, and the iron thus recovered is good for something more than sash-weights. Here is a letter on this point from a practical foundryman of wide experience:

The W. W. Sly Manufacturing Co.,
Cleveland, Ohio.

Gentlemen:

We recently made a test of the iron recovered from cinder-dump. We weighed 1980 pounds of shot, poured it into castings weighing from one to three pounds, and the balance into pigs. All the castings, pigs, gates, and sprues were then weighed, showing we had 1780 pounds of iron, a loss of a little more than 10%, but considering the iron dropped with the bottom and again recovered, the loss would be even less. The small castings drilled readily, and the bars graded made a satisfactory showing. We also made some test bars of this iron and found it tested above the average as to strength.

Yours very truly,
THE FOOS MFG. CO.,
Per W. F. Foos.

The Sly mills are substantially constructed and require no high-grade labor to operate them. The crusher plays an important part in the efficiency and quantity of the work performed and its design is the result of long experiment. The foundryman who is crushing his cinder in a stave-mill or throwing it away as waste will do well to consider the uses to him of this mill.

SURFACE-GRINDER

The type ME portable surface-grinder manufactured by the United States Electric Tool Co. is shown in the illustration. This grinder is used for cleaning and grinding heavy castings and for polishing and buffing all kinds of metals and glass. The grinder can also be employed for sanding,

Surface-Grinder

and can be used with a balance-weight as well as with a spring. The motor is air-cooled and has ball-bearings. It can be furnished for either direct or alternating current, 110 or 220 volts. The weight is 112 lb. Harron, Rickard & McCone, San Francisco and Los Angeles, are the Pacific Coast agents.

The Associated Pipe Line Co. has purchased a Pangborn sand-blast outfit to clean 20 miles of pipe. This pipe has been underground for several years. The company has decided that it will be profitable to remove the pipe from the ground and remove the rust and other accumulations by the sand-blast method, a considerable saving being made over the price of new pipe or by the old method of removing the rust by hand.

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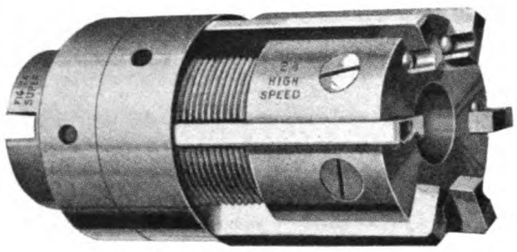
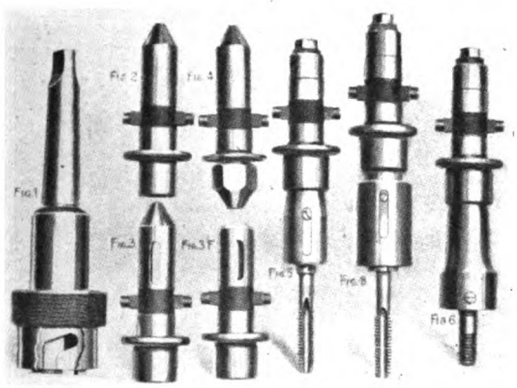
REAMER AND CHUCKS

The McCrosky Tool Corporation, Meadville, Pa., has issued folders describing its adjustable reamers and Wizard chucks and collets. The adjustable reamer has a large adjustment to provide for wear and regrinding and the blades are easily renewable and at small cost. The reamer is practically a solid one when assembled. The locking-key is made of hardened drill-rod and the powerful steel locking-screw is also hardened. Dependence is not placed upon friction alone to hold the blades in place, each blade being fixed in exact position by a positive lock. The blades are adjusted forward instead of backward in order to increase



Adjustable Reamer



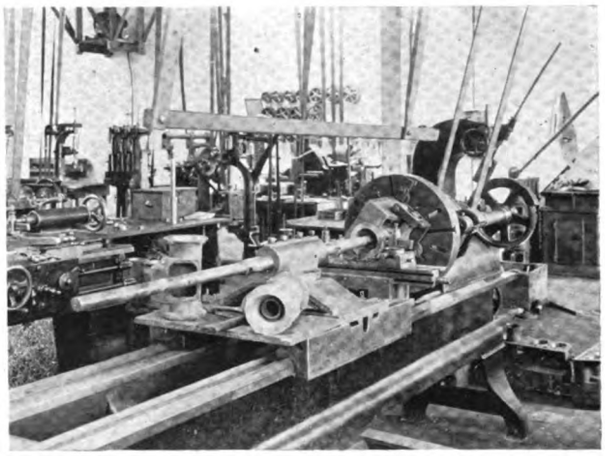
Wizard Outfit of Chucks and Collets

the diameter of the reamer, although it does not lose its bottoming feature, and the cutting end of the blade is always in advance of the reamer-body regardless of how many times the blades are re-ground or adjusted. Only six sizes of blades are required to fit all sizes of shell and chucking reamers from $\frac{15}{16}$ in. to 6 in. The same is true of the hand-reamers. With the Wizard chuck and collet outfit, it is possible to carry through the whole series of operations on a single-spindle machine continuously without stopping the spindle and with only one handling of the work. A touch of the hand opens the chuck and releases the tool and the next tool is inserted into the chuck just as easily. No time is lost, nor is any mechanical skill required. A Wizard outfit consists of one Wizard chuck for the machine-spindle, one collet for each tool or operation on the job, and a stand for holding the various collets and tools within easy reach of the operator. Any number of Wizard collets are interchangeable in one Wizard chuck.

The Emergency Fleet Corporation will receive bids until September 10 for the purchase of the yard built for the Corporation at Raymond, Washington, by **Sanderson & Porter.** The yard has an area of 23 acres, with 2500 ft. of frontage on the Willapa river. There are five ways, capable of the construction of complete hulls up to 4000 tons capacity. Ten 3500-ton wooden ships of the Ferris type were built at this yard.

TWO DEVICES USED BY MANN MANUFACTRING CO.

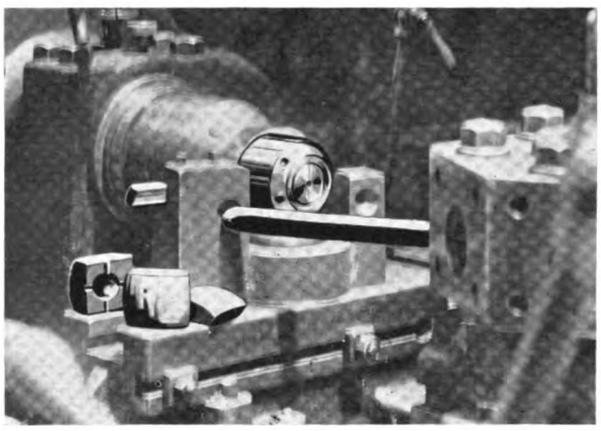
For machining a special transmission case in quantities, the Mann Manufacturing Co. rigged up a simple and effective turret. The job is clamped in an automatically centring chuck. A roughing cut is taken by the first tool on one of



Machining Transmission Case

the boring bars and the turret is then moved forward and a roughing cut is taken on another part of the transmission case. The bar is then withdrawn and the turret revolved and a finishing cut is made by the tools on the other bar. At the same time the case is faced by two cross-slide tools.

An ingenious arrangement is used by the Mann Manufacturing Co. for turning an outside radius on an automo-



Turning Outside on Toggle-Block

bile toggle-block using the power-feed of the turret. Two blocks at a time are held in an automatic clamp, which tightens with a quarter of a turn of the head. The tool-holder swings on a centre describing an arc of the correct radius. The power-feed of the turret is transmitted to the tool by means of a bar, which is fast to the turret and is fitted loosely in a socket in the tool-holder.

THE SCHMIDGALL BIT FOR SQUARE AND OTHER SPECIAL-SHAPED HOLES

A special-type bit for drilling square and other holes of unusual shape has recently been developed by C. H. Schmidgall, of Peoria, Illinois. It can be used both for wood and for harder substances, such as steel and marble. For wood the entire hole can be bored in one operation, whereas for the harder materials, the round hole is drilled first, and is then squared or otherwise shaped in a final operation.

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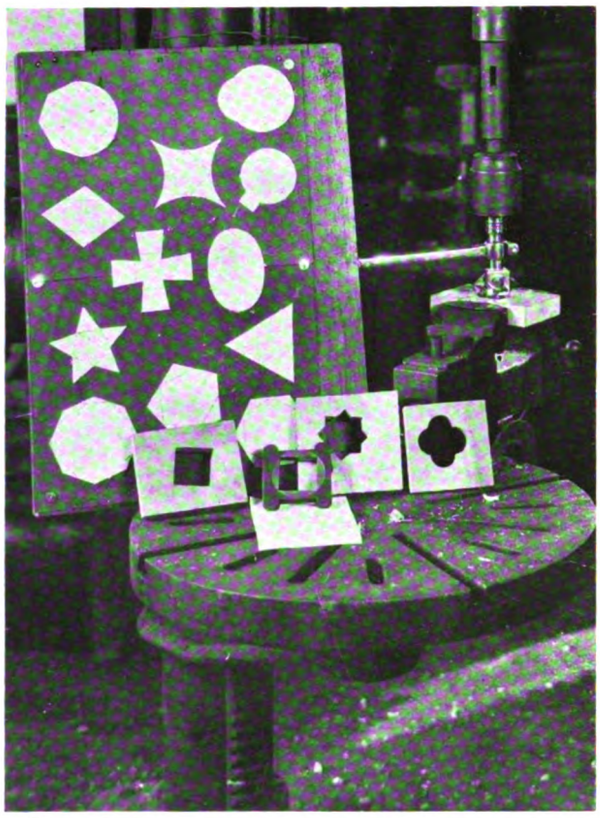
The accompanying illustration shows the complete tool fitted with bits for boring a square hole in wood. The device consists of several rotary bits, five in this case. The leader, the bit starting the cut, is an ordinary wood-boring bit mounted in the usual manner on the lower end of a



The Schmidgall Bit

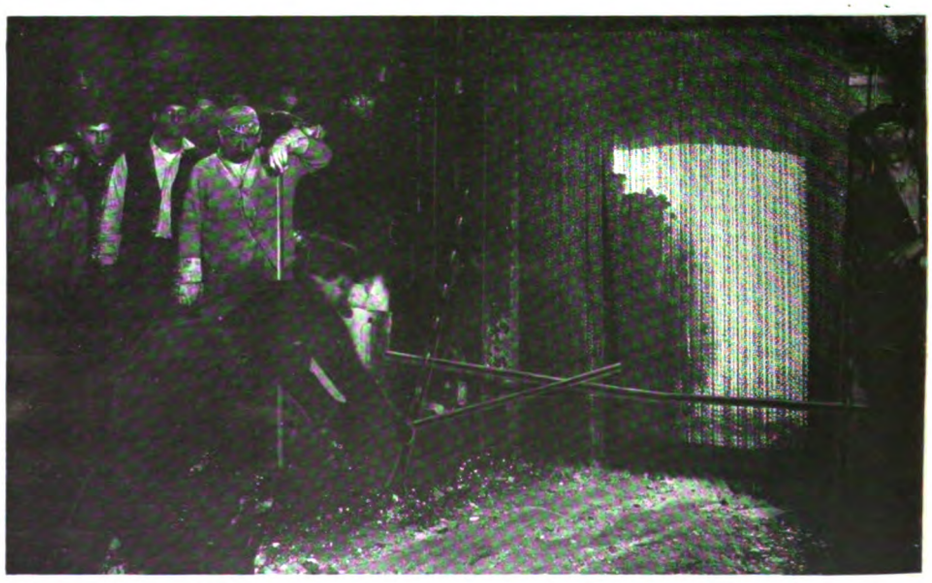
central vertical shaft. The four cone-shaped or V-bits that square the holes are mounted on short horizontal spindles radiating at equal angles from the central vertical shaft. The four horizontal spindles are geared with mitre-pinions to the central shaft, but the gearing is enclosed in a compact square casing as shown.

The bits are interchangeable; each one is drilled and tapped at the back to fit the threaded ends of the horizontal spindles. By distributing different-shaped bits around the square casing, various-shaped holes can be made, such as diamonds, ovals, or any shape which can be conveniently 'built up'. For boring three-cornered holes a sleeve with a three-sided casing containing three radiating spindles, is used, and similarly a hexagon-casing containing six radiating spindles is used for boring hexagon holes. There is really no limit to the number of combinations that can be based on this principle. The mitre-gears in the casing of the tool are so proportioned that the horizontal bits rotate about one-third faster than the large vertical bit, therefore they will cut rapidly and freely at any ordinary boring-machine speed. In demonstrating the tool, Mr. Schmidgall has run it at various speeds up to 2000 r.p.m. In case it is desired to bore a square or other shaped hole only part way through a block of wood, the leading bit, which bores the preliminary round hole, can be removed when the round hole is made in order to let the horizontal milling cutters down into the bottom of the hole. In squaring a round hole in metal or stone, the leading bit is replaced with a disk just large enough to fit the hole. This disk then advances through the hole just ahead of the milling cutters and serves to keep them in line with the round hole. The casing containing the horizontal bits is prevented from turning by being clamped securely in the jaws of an extended arm as shown. This arm also serves to steady the bit as it enters the cut. The arm can be made stationary in case it is desired to advance the work to the tool or can be arranged to slide in ways fastened to the machine-frame, in case the bit is advanced to the work. Ball-bearing end-thrust collars are mounted just above the jaws of the extended arm, as shown.

THE WEIGAND CHAIN-SCREEN DOOR FOR FURNACES AND OVENS

The disadvantages attendant upon the opening of the ordinary type of furnace-doors, including heat and gases coming out of the furnace and cold air rushing into it, are too well-known to require comment. To eliminate these disadvantages, the Weigand chain-screen door has been developed by the E. J. Codd Co., of Baltimore. These chain-screen doors, in the form commonly used on steel and other furnaces, consist of a number of freely hanging individual strands of steel chain suspended close together from a steel bar so as to form a continuous sheet or curtain of chain. This curtain of chain effectually hinders the heat, glare, gases, and sparks from leaving the furnace and the cold air from entering. The loosely hanging strands are parted and pressed aside with ease by the tools or other objects projected into the furnace, only to fall together again when entrance has been effected.

The style of screen used on most metal furnaces is non-automatic in action and is of simple construction. The bar from which the chains hang may be either fixed or movable. When movable, it is provided with an independent suspension. The bar carrying the chains has extensions on either end, which rest in brackets at the side. When not needed, the screen may be raised out of the way. In some steel plants, the screens are attached directly to the bottom of the



The Weigand Chain-Screen Door

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ordinary vertically-sliding furnace-door. When the door is lowered, the screen drops below the hearth and out of the way. This form may be used when the hearth does not extend beyond the bottom of the sliding door. In plants where the furnace or oven charge is handled with tongs, the lower half of each strand of chain is replaced with a light steel tube. This prevents the chain catching in the crotch of the tongs. Where constant visibility is not required, the screens may be constructed with nearly the entire strand made of tube, a short length of chain being placed at the top for flexibility. Such screens are especially impervious to heat, although retaining the flexible and penetrable features. Where several furnaces are grouped in a continuous line and not more than one is opened at a time, one screen mounted on an overhead track can be made to do duty for all.

This chain-screen door appeals particularly to the safety engineer, as besides protecting the operator's whole body from the intense heat, it saves his eyes from the bad effects of the glare.

INFORMING THE PUBLIC ABOUT LOCAL INDUSTRIES

The accompanying illustration is taken from a photograph of an exhibit recently staged on one of the busiest

Cutting Gears on a Busy Street Corner

streets of Cleveland, Ohio, through the co-operation of a leading bank and the Van Dorn & Dutton Co. Its object was to educate the public and to bring home to them the fact that one of the most modern gear-plants in the country was situated in Cleveland. The exhibit included a Gleason spiral bevel-gear generating machine cutting gears from forged steel blanks. There were also panel-boards showing gears of all kinds, types, and materials. The fact that an exhibit of this kind was considered worth while in a typically industrial city such as Cleveland illustrates the importance of taking every opportunity of informing the public about the activities of the metal industries.

David Rodgers, general manager for the Skinner & Eddy Corporation, has resigned because of ill health.

CARBORUNDUM AND ALOXITE ABRASIVES

Carborundum was developed by Edward G. Acheson in 1903 during the course of a series of electrical experiments. It is now manufactured by the Carborundum Co. at Niagara Falls, the output being about 1,000,000 lb. per month.

The word 'carborundum' is the trade name for carbide of silicon. The substance does not exist in nature, but is made by subjecting a mixture of coke, sawdust, sand, and salt to the intense heat of the electric furnace. A temperature of 4060°F. is maintained for 36 hours. At the end of this time, the sides of the furnace are removed and the mass allowed to cool in the air. The outer parts of the mass have not been heated sufficiently to change them materially. Next to these outer parts is the amorphous or uncrystallized carborundum. At the centre is the crystallized. The unchanged mass is charged over again, the uncrystallized carborundum is used for refractories, and the crystals are used for grinding and other abrasive work. The heat has eliminated all impurities from the carbon and silicon, which have united.

The mass of crystals is then crushed and screened, the screens used ranging from 6 to 220 meshes to the inch. As carborundum itself is infusible a bonding material is required when making grinding-wheels. Among the materials used are certain clays, rubber, shellac, and silicate of soda. Because of the wider range of grades available, wheels bonded with clays, commonly called vitrified wheels, are the most common. If a wheel that will cut less harshly than the vitrified wheel is required, silicate of soda is used. Thin wheels and wheels of special shapes that are run at high speeds and are subjected to heavy side-strains are usually bonded with rubber or shellac. The hardness of a wheel, or its ability to resist crumbling when in use, is determined by the proportion of the grain to the bonding material.

After the clay is mixed with the carborundum crystals and the wheels are fashioned to shape, they are baked in a kiln where the temperature is raised slowly to 2500°F. The kiln is then sealed and allowed to cool slowly. The processes for making wheels with other bonding materials differ in various particulars from that outlined, but a certain degree of heat for a given length of time is an important factor in all of them.

After baking, the wheels are dressed, balanced, and tested under speed and for other requirements. Carborundum sharpening stones are manufactured in much the same general way. Carborundum paper and cloth is made by spreading the crystals over properly glued stock.

Another abrasive recently developed by the Carborundum Co. is aloxite, which is pure aluminum oxide. It is made in an arc-type electric furnace. The rest of the manufacturing process is similar to that used with carborundum. It is used principally for grinding steel. It is hard, sharp, and tough, and has the right amount of temper for grinding steels or other materials of high tensile strength, whereas carborundum is better adapted for grinding materials of low tensile strength, such as cast-iron, brass, and leather.

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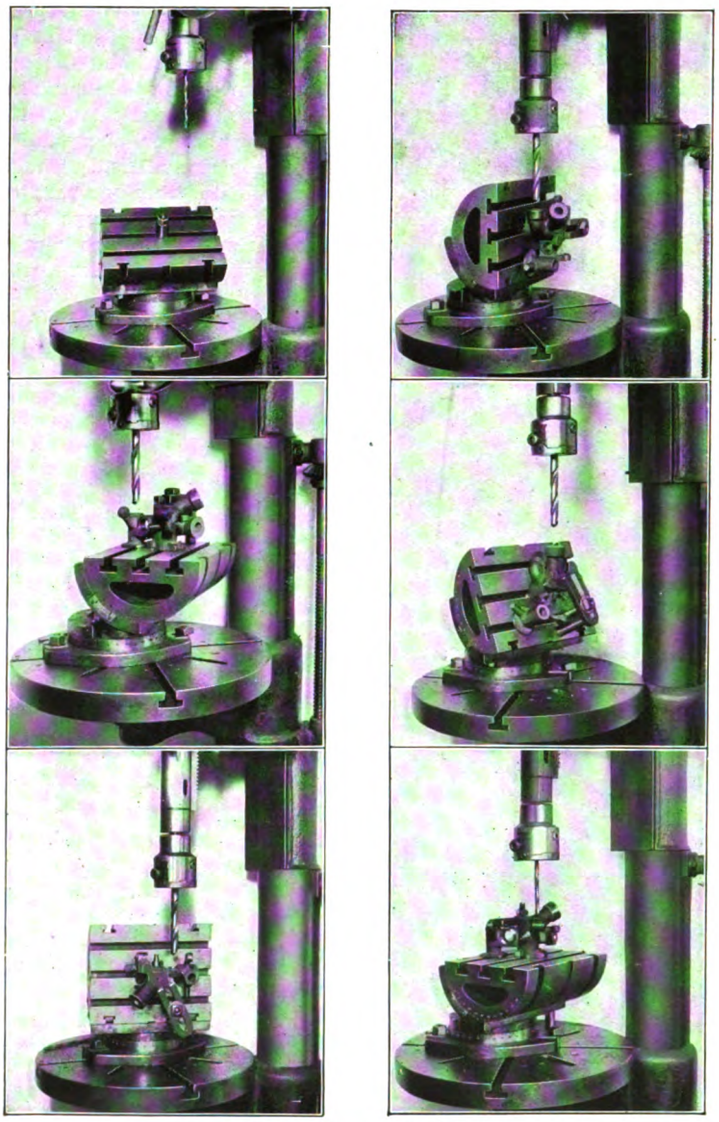
THE UNIVERSAL ANGLE-PLATE

The Universal angle-plate manufactured by the Boston Scale & Machine Co. is a modern accessory for the tool-room and workshop. This device is particularly adapted to the tool-room. Used with a grinder, formed cutters can be ground on it by addition of centres to the platen. It has a motion through any degree horizontally and 90° vertically.



Various Positions of Angle-Plate

It can be adjusted quickly to any angle without disturbing work bolted to it, and the motion of the working surface is through the axis of the arc of its oscillation. Accurate graduations with vernier attachment reading to 5 minutes, permit of its use for especially fine work. The tool is rigid and well built, and has unlimited possibilities of application for work with lathes, planers, milling machines, shapers, drill-presses, and grinders, as well as in connection with die-sinking machines.

The Sullivan Machinery Co. announces the appointment of R. S. Weiner as district manager at El Paso, Texas, succeeding Don M. Sutor. Mr. Sutor has been transferred to the company's St. Louis office as district manager for Missouri, eastern Texas, Oklahoma, Kansas, western Kentucky, and western Tennessee. The company's office at El Paso remains at room 511 Mills building, as heretofore.

TRADE NOTES

Charles La Bat and **N. Guyman** have opened an automobile-repair shop at 322 North California street, Stockton.

The Madsen Iron Works, of Los Angeles, has acquired five acres at Vernon for the construction of additional buildings.

The Pacific Copper & Brass Co., of Los Angeles, is constructing a one-story brick addition, 100 by 150 ft., to its factory.

Contract for construction of a courthouse at Winnemucca has been awarded to **H. S. Williams,** of San Francisco, for $120,000.

The Western Glass Products Co. of Los Angeles will construct a plant at Torrance for the manufacture of glassware of all kinds.

F. O. Renstrum Co. has been appointed distributor in California and Nevada for the **Minneapolis Steel & Machinery Company.**

The Southern Pacific Co. has recently completed at its Sacramento shops an 85 by 165 ft. building devoted entirely to the manufacture and repair of railroad frogs.

The Scripps-Booth Co. of California, a subsidiary of the **General Motors Co.** will construct several reinforced concrete buildings in East Oakland for an automobile factory.

The Board of Directors of the **Oakdale Irrigation District** are considering the construction of the proposed Melones dam, about 16 miles from Oakdale. The estimated cost is $1,469,490.

The Berger & Carter Co. has leased property at Third and Crocker streets, Los Angeles. A two-story building will be constructed there to house the Los Angeles branch house of the company.

H. Jones & Co., Ltd., of Hobart, Tasmania, will construct a canning factory on Fruitvale avenue in East Oakland. The estimated cost is $600,000. Work will probably commence in October.

Macdonald & Kahn have been awarded a contract for the construction of a seven-story reinforced concrete building at Sacramento for the George W. Cowen Co., Inc. The estimated cost is $250,000.

E. W. Miner has sold his interest in the **Newport Iron Works** at Newport, Washington, and has established the **Miner Machinery Exchange** at Spokane, where he will handle all kinds of machinery.

An election will be held September 23 in San Luis Obispo county to vote on a bond issue for $1,500,000 to provide funds for a county highway system, bridges, and the acquisition of land for a new courthouse.

The United States Reclamation Service will receive bids at its Denver office until October 1 for furnishing balanced needle-valves, high-pressure emergency-gates, and sluice-gates for the north tunnel at the Pathfinder dam.

The Standard Fuel Engineering Co., of Detroit, has issued a 40-page catalogue of the gas and oil-fired furnaces made by the company. Some of these furnaces are designed for heat treatment and others are for melting soft metals.

The John A. McEachern Co. is constructing a station at Harbor island, in the vicinity of Seattle, for supplying vessels with fuel and lubricating oil. Several large tanks will be constructed. The total estimated cost is $500,000.

The Warnerlite Co., of Davenport, Iowa, which makes lighting plants and electrical apparatus for automobiles, will establish a branch factory at Pasadena. The estimated cost of the plant is $100,000. About 500 men will be employed.

The Trewhitt-Shields Co. of Fresno will have charge of

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the construction of $1,000,000 worth of school-buildings to be erected in that city. Bonds for this work have already been voted. The contract is on a cost-plus-percentage basis.

Construction of the first unit of the plant of the **Kroyer Manufacturing Co.** at Stockton has been postponed for a few months. Unsettled manufacturing conditions are given as the reason.

The Wallace H. Dow Co. has moved from San Francisco to Petaluma where it will operate a foundry and machine-shop for the manufacture of pumps and engines. It is expected that the plant will be in operation about September 1.

The Keystone Steel & Wire Co., of Peoria, Illinois, has opened offices in the Monadnock building, with E. M. Morey in charge. Mr. Morey will handle sales in California, Nevada, Arizona, Oregon, and Washington, as well as Pacific export business.

The Oregon State Highway Commission reports that it has work under way on highway contracts amounting in all to $16,903,000, including 370 miles of concrete and other hard-surface pavement, 193 miles of macadam, and 528 miles of plain grading.

Charles A. Mills has opened an office at 501 Sheldon Bdg., San Francisco, as exclusive representative of the Central Scientific Co., laboratory equipment, H. Reeve Angel & Co., filter-paper, the Hoskins Electric Manufacturing Co., electric furnaces and pyrometers, and the Wilmot Castle Co., sterilizers.

The Southern California Iron & Steel Co. will construct a new plant on a 25-acre tract at Huntington Park. The estimated cost is $1,750,000. The plant will include open-hearth furnaces, a rolling-mill, machine-shop, nut and rivet shop, forge-shop, galvanizing-shop, warehouses, and office buildings.

Contract for the construction of a tank-steamer for the **Standard Oil Co.** has been awarded to the **Union Construction Co.**, the lowest bidder. The Schaw-Batcher Shipbuilding Co., Moore Shipbuilding Co., Bethlehem Shipbuilding Corporation, and Pacific Coast Shipbuilding Co. also bid on this work.

Harron, Rickard & McCone have just issued an illustrated 20-page catalogue of their equipment for repairing tractors, trucks, and automobiles, including lathes, grinding-machines, milling-machines, drills, power-saws, chain-hoists, compressors, pneumatic riveting and chipping hammers, welding and cutting outfits, and other implements.

The Shore Instrument & Manufacturing Co., of New York, has recently issued the eighth edition of its book on the Shore Scleroscope. This is a neatly-bound volume of 80 pages, which, besides describing the use of the scleroscope, contains much valuable general information regarding hardness, tempering and other heat treatment, and allied subjects.

The Master Carbureter Co. of Los Angeles is constructing a plant at 30th and Main streets, occupying a floor-space 130 by 150 ft. and which will have a capacity of 10,000 carbureters per month. The plant will include a foundry for making brass and aluminum castings, a machine-shop, and a research laboratory. The company manufactures carbureters adapted to every make of gasoline-engine.

The Norton Co., of Worcester, Massachusetts, announces the consolidation of the Norton Co. and the Norton Grinding Co. under the name first mentioned. The board of directors is as follows: Charles L. Allen, president and general manager; George I. Alden, chairman of the board; Aldus C. Higgins, treasurer and general counsel; George N. Jeppson, secretary and works manager; R. Sanford Riley, and John Jeppson.

The Moreland Motor Truck Co. is building extensive additions to its plant at Burbank. Unit No. 1 was completed a year ago and has been in operation ever since. The buildings to be constructed are Unit No. 2, which will contain the machine-shop, storeroom, and assembly department; Unit No. 3, which will contain the testing, body-building, and painting departments; and Unit No. 4, which will contain the forge, riveting, heat-treating, and sand-blast departments. An administration building will also be constructed.

At the Robbins plant of the **American Can Co.** cast-iron borings are being put up in gallon cans and sold to the foundries. Defective cans and an old canning machine are used to make a product, otherwise valueless, worth $18 per ton. Something has to be done with these borings, and it costs only a little more to can them than to haul them away. Loose borings burn up and are lost in the cupola whereas the canned product holds together and melts like a solid piece of iron.

The Electric Furnace Co., of Alliance, Ohio, reports the installation of the following Baily furnaces: Two standard 105-kw. furnaces at the Capitol Brass Works, Detroit, to be used for melting yellow-brass scrap and borings. A 105-kw. furnace for the Buick Motor Co., Flint, for melting phosphor-bronze. A 50-kw. furnace for the Akron Bronze & Aluminum Co., to be used for red and yellow brass, gunmetal, and phosphor-bronze. A 105-kw. furnace for the Dayton Engineering Laboratories, to be used for aluminum.

As a result of recent transfers of stock, entire control of the **Willamette Iron & Steel Works** passed into the hands of the directors and other officers actively concerned in the management of the plant. The present officers are: Bert C. Ball, president; A. G. Labbe, vice-president; M. H. Insley, secretary; H. V. Carpenter, treasurer; Charles F. Swigert, H. L. Colvin, and E. C. Pape, directors. Control of the Independent Foundry Co. was also secured, and the foundry will now be operated as an adjunct to the Willamette Iron & Steel Works.

The Overstrom Manufacturing Co. announces that its Los Angeles factory and offices have been closed, the factory having been moved to Berkeley, California, where it will be more closely in touch with and directly under the supervision of the main office of the company in San Francisco. The company therefore requests that all communications, inquiries, orders, etc., regarding Universal concentrating tables, for use in the United States and its possessions, be sent to the Overstrom Manufacturing Co. at its main office, 1215 First National Bank Bdg., San Francisco.

The Pangborn Corporation has issued a handy and condensed catalogue of its sand-blast and allied equipment for the convenience of those who are interested in this line. Because of the many types and sizes in the complete line, these brief descriptions enable the reader to understand the basic principles, individual features, and capacities of the different units. Detailed information and data on such units as are of particular interest will be sent on request. Economy in sand-blasting lies in the application of the right equipment to the work in hand. The catalogue can be obtained through **Ditty Bros.**, San Francisco and Seattle, who are the Pacific Coast agents.

At the Robbins plant of the **American Can Co.** every forming die sent out with the can-sealing machines is tested with a scleroscope and the hardness recorded. Some valuable information has been obtained in this way and it has been possible to make improvements in the wearing qualities of the dies through the possession of data regarding the exact hardness of dies reported defective. The scleroscope is coming into greater use as mechanics become familiar with its advantages. It is now passing through the same stage through which the micrometer went not so many years ago. Many mechanics used to think they could measure close enough without the micrometer and were rather scornful of its use.

'Twist-Drills, Their Uses and Abuses' is the title of a valuable little booklet, the seventh edition of which has just been issued by the **Cleveland Twist Drill Co.** The booklet

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presents a brief but comprehensive collection of information based on the company's own practice and observation in the use of twist-drills. It is aimed to assist users in obtaining increased cutting capacity combined with maximum durability and general satisfactory performance. As the introduction states, the company is aware that the volume contains little new or original matter, but there are numerous users of twist-drills that have not had the opportunity to acquire the needful information, and it is especially for this class of workmen that the booklet is intended.

The Main Iron Works is consolidating its work at its Seventh Street shops. The boiler-shop and machine-shop at Main and Folsom streets have already been moved. The shop at Main and Howard streets will probably be vacated by January 1. Some of the heavy machines have already been moved. New buildings for the offices and for pattern storage will be erected at the Seventh Street site. The boiler-shop at Main and Folsom streets, together with the crane and equipment, has been sold to **P. Shecter,** who will consolidate at this site his two enterprises, the Western Machinery Co. and the Shecter Pipe Works, which are now on Howard street.

An electric apparatus for detecting small power losses and so determining the efficiency of gears has recently been perfected by C. M. Allen, Professor of Hydraulic Engineering at the Worcester Polytechnic Institute. A number of tests were made with this apparatus to determine the best sort of gear lubricant. The best results were obtained with a mixture of heavy oil and flake graphite. With a perfect blending of the oil and graphite there was a minimum loss through friction. The **Joseph Dixon Crucible Co.,** Jersey City, N. J., claims that this test proves that flake graphite properly combined with oils and greases is unexcelled because of its ability to build up microscopic irregularities in gear surfaces, forming a tough film of graphite, and so preventing metal-to-metal contact.

The Columbia Steel Co. has commenced work on a rolling-mill at its Pittsburg plant and expects to have the buildings completed by January 1. The structures will include a billet-yard building, 60 by 240 ft.; two mill buildings, 60 by 200 ft. and 40 by 200 ft.; two hot-bed buildings, each 40 by 200 ft.; and a storage building, 80 by 200 ft. The mill will be equipped with 18-in. roughing rolls, 18-in. finishing rolls, and 12-in. finishing rolls, equipment to be furnished by the United Engineering & Foundry Co., of Pittsburgh, Pennsylvania. Other equipment will include two 10-ton and one 5-ton Cyclops crane. The Federal government now has plans under way for the dredging and maintenance of a 35-ft. channel as far as Pittsburg. To provide room for these extensions, the company has purchased eight acres of land, making its total holdings 28 acres.

The Pacific Coast Bureau of Employment Research has opened offices in the Flood building, prepared to assist employers in the Bay district and elsewhere in the solution of personnel and employment problems. The staff of the Bureau includes Wilford E. Talbert, director, formerly with the Bureau of Personal Research at the Carnegie Institute of Technology; J. D. Houser, formerly in charge of intelligence testing at Camp Kearny; Arthur S. Otis, formerly statistician in the surgeon-general's office, department of psychology; C. C. Stech, in charge of intelligence and trade testing at several Army camps; and Roy W. Kelly, formerly director of the Bureau of Vocational Guidance at Harvard University, also in charge of courses in employment management, and author of 'Hiring the Worker', 'Training Industrial Workers', and other books and articles on employment problems. The motto of the Bureau in its research work is 'What are the facts?', and it is believed that a knowledge of the facts coupled with advice based upon the combined experience of the staff of the Bureau will be of service to employers.

Circular No. 7375, describing the company's achievements in the field of electrical precipitation, has just recently been issued by the **Westinghouse Electric & Manufacturing Co.** The process applies to copper, lead, or zinc smelters, blast-furnaces, and chemical, acid, and cement plants, and permits the recovery of valuable material otherwise wasted. Water can be precipitated from oil, dust removed from ventilating systems, etc. It is also applicable to buildings such as roundhouses, where smoke or fumes are produced that are a nuisance to the surrounding territory. The necessary apparatus for the precipitation process such as motor-generators, transformers, rectifiers, motors, switchboards, and accessories are shown installed, and are described in detail in this circular. While there are several mechanical and chemical methods for collecting or suppressing dust in furnace and kiln operation, they are in general limited in application by conditions of temperature, acid, and similar qualities of the product to be handled. Electrical precipitation has few limitations of this sort and is generally applicable for collecting suspended solid and liquid particles of every description, whether acid or alkaline, and from gases of widely varying temperature.

Market Review

The market for iron and steel products is strong and advancing all along the line. In the Eastern centres both pig-iron and coke have advanced about $1 per ton during the past month, the ruling prices August 27 being as follows:

No. 2 foundry, Pittsburgh	$28.15
Southern, No. 2, Birmingham	26.75
Connellsville foundry coke	6.00

Finished products are in good demand at the prices named March 21 by the Industrial Board. The only notable instance of shaving these prices was in the bid submitted by the Carnegie Steel Co. for furnishing about 28,000 tons of steel for the Brooklyn Navy Yard. The Carnegie company bid $2.50 for plates, $2.40 for shapes, and $2.35 for bars, or $0.15 lower on plates and $0.05 lower on shapes than the ruling prices. Three other companies bid on this contract, all at the ruling prices.

The local market is also strong, jobbers reporting better sales than during any previous month since the armistice. Many sales of pig-iron have been made, partly because consumers that were heavily stocked before the armistice have at last exhausted their supplies and are obliged to come into the market again, and partly because consumers foresaw the rise in pig-iron and bought early in the month in order to protect themselves. Local prices at the end of the month were as follows:

Foundry pig, per ton	$47.00
Coke, per ton	22.00
Steel bars, warehouse, carload lots, per 100 lb.	4.00
Steel bars, warehouse, less-than-carload, per 100 lb.	4.60

Scrap is in good demand. Cast-iron scrap is scarce and is selling around $42 per ton. Steel scrap is quoted at $20 per ton.

The market for non-ferrous metals has been subject to considerable fluctuations during the month, but the prices have now stiffened and are almost the same as at the beginning of the month. Local prices are as follows:

Electrolytic copper	23.50
Casting copper	23.00
No. 1 red ingot brass	20.00
No. 1 yellow ingot brass	15.50
Electrolytic zinc	9.75
Prime Western zinc	9.00
Pig lead, carload lots	6.25
Pig lead, ton lots	6.50
Antimony	9.00

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